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D3.3: SECOND BEST PRACTICES MANUAL

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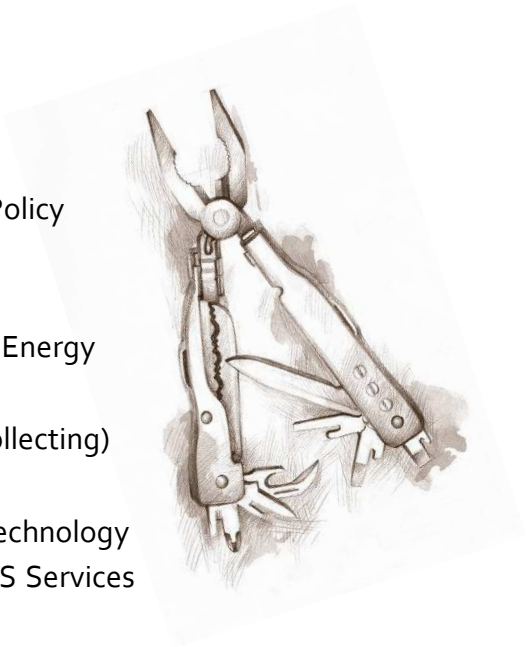
1. Abstract

When we buy a new appliance, a new toy for our kid or a "put-it-together-yourself" table to save a little money, we usually take out all the pieces from the box and look for the manual. It is our hope that this booklet, presented in one thousand languages, will give us some insight to how the heck this all works. There are some manuals that even provide a plastic bag with tools to help you assemble it. Those are the best. We don't even have to go digging though the tool box to find the right wrench or nail to use. With this idea in mind, we have created this manual.

It is a manual that provides the information and fundamental tools necessary to help public entities, energy managers and building users analyze the current energy use situation in different types of public buildings, to get started on the road to energy savings and to stay motivated to keep going.

Since not many people have the time these days to read lengthy texts about watts and volts, the manual has been laid out using simple texts, practical worksheets, templates, tip sheets and check lists. Together they create a "toolbox" for energy savings.

This tool box is necessary since being informed alone on best practices will not save energy. Knowledge of best practices must be accompanied by commitment, an assessment of the situation, great planning, communication and action.



Here is a brief list of what EPLACE toolbox contains:

- Company Management Statement and Policy (example)
- Employee questionnaires (example)
- Building Information and Historical Energy consumption (Tables for data collecting)
- Self-Survey of Energy Use (Tables for data collecting)
- Company Energy Plan (Template)
- Tip sheet for Buyers of Energy Efficient Technology (also see our more extensive Energy and RES Services Guide)
- Tip sheet for Best Operating Practices
- Energy management tools
- Tools for energy conservation and efficient measures in the workplace
- List of creative ways to motivate staff
- Analysis of savings and improvements
- Examples for reporting
- EPLACE Case Studies: Best Practices and Behaviours

A note of inspiration:

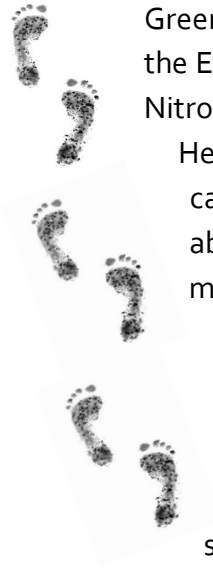
The entire The entire nation of Cuba, a country we must note has a very tight budget, was able to reduce its energy needs by half over a four year period of Cuba, a country we must note has a very tight budget, was able to reduce its energy needs by half over a four year period.

2. The benefits

What do we have to gain by starting or participating in an energy programme in our building?

There is a lot to be gained in creating a programme for energy savings in your company and it isn't all based on saving the environment and money. Here are some of the top reasons to start an energy programme.

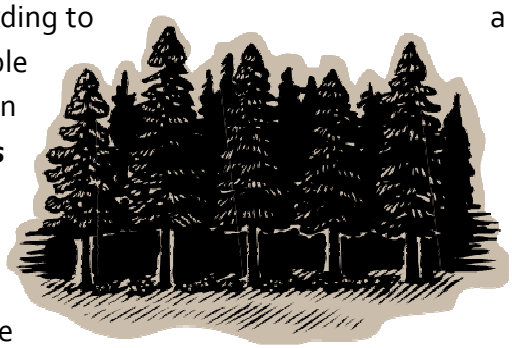
- ✓ **Reduction of CO2 and other Green House Gases, *bla bla bla***



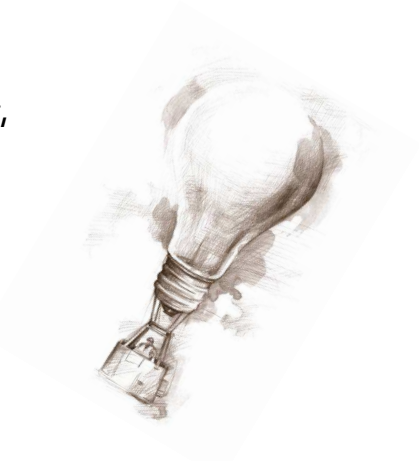
Green house gases are those gases that impede heat from escaping from the Earth's atmosphere. They include gases like Carbon Dioxide (aka CO_2), Nitrous Oxide and Hydro Fluorocarbons, Per Fluorocarbons and Sulphur Hexafluoride. To get straight to the point, the increase of these gases can dictate if our beach homes weather another season, if we will be able to afford those tomatoes we really fancy at the market and how much we spend on air-conditioning.

Everyone who hasn't been in a cave since 1990 will know that saving energy can reduce the amount of green house gasses we emit into our atmosphere. Since this would not be a proper manual without mentioning the importance of its reduction, we will state it with a short factoid.

The average house in Ireland is responsible for emitting **8.1 tonnes** of CO_2 based on the latest year for which data is available, according to a new report published today by Sustainable Energy Ireland (SEI). To offset the carbon produced you would need **208 tree seedlings grown for 10 years** (according to the calculator presented on www.epa.gov). Those are a lot of seedling! If you are indeed lucky enough to have a yard, can you honestly say you have planted that many trees?



✓ **Let´s talk MONEY**



The phrase goes "A penny spar'd is twice got" or "penny saved is a penny gained" depending who you ask. However, it all boils down to the same equation:

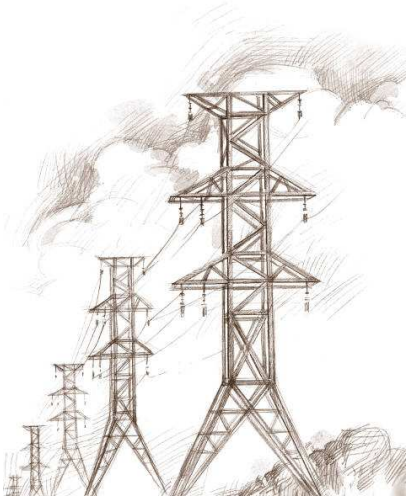
Energy savings = money saved

Money is undoubtedly a very good reason to start saving energy. Would you throw money out the window? Then why continue with an old system that isn´t efficient?

Let's start at our desk. Up to **30 %** of the energy used at our desk can be saved by changing our practices.

Here is a practical example to see how much we can save in just changing light bulbs. Keep in mind that the price for a LED luminary is set at an elevated price and the cost for LED is continually decreasing.

Variables	LED	CFL	Incandescent
Light bulb projected lifespan	50,000 hours	8,000 hours	1,000 hours
Watts per bulb (equiv. 60 watts)	7	14	60
Cost per bulb	€14.00	€3.95	€1.00
KWh of electricity used over 50,000 hours	350	700	3000
Cost of electricity (0.10per KWh)	€ 42	€ 84	€ 360
Bulbs needed for 50k hours of use	1	7	50
Equivalent 50k hours bulb expense	**€14.00**	€19.75	€50.00
Total cost for 50k hours	€56.00	€103.75	€410.00
Energy Savings			
Total cost for 25 bulbs	€1400	€2593.77	€10,250
Savings to household by switching from incandescent	€8850	€7656.25	0



✓ **Breaking the chains of dependence = control**

In the last years we have seen our dependence on energy increase and oil become harder to obtain. This can create challenges for governments to meet national energy needs. Use of renewable energies (wind, sun, biomass, etc) can help reduce the dependence on other countries to supply energy. It also reduces risks for international conflicts and ensures national security and sustainability.

✓ **Increased communication in the work place**

This may not be so obvious but it is just as important. A good energy savings programme starts with a commitment that is well communicated from top management. These programmes can often open new methods for other communication and awareness programmes that could have broken down over the years. Communication and training is fundamental in any workplace to ensure optimal efficiency and worker satisfaction.

✓ **Happier, healthier and more satisfied workers= increased productivity**

It is a quite simple equation. When workers feel listened to, that what they do matters, that their boss cares about their wellbeing; workers will be more dedicated and ultimately be more productive.

✓ **Transfer of good practices to the home.**

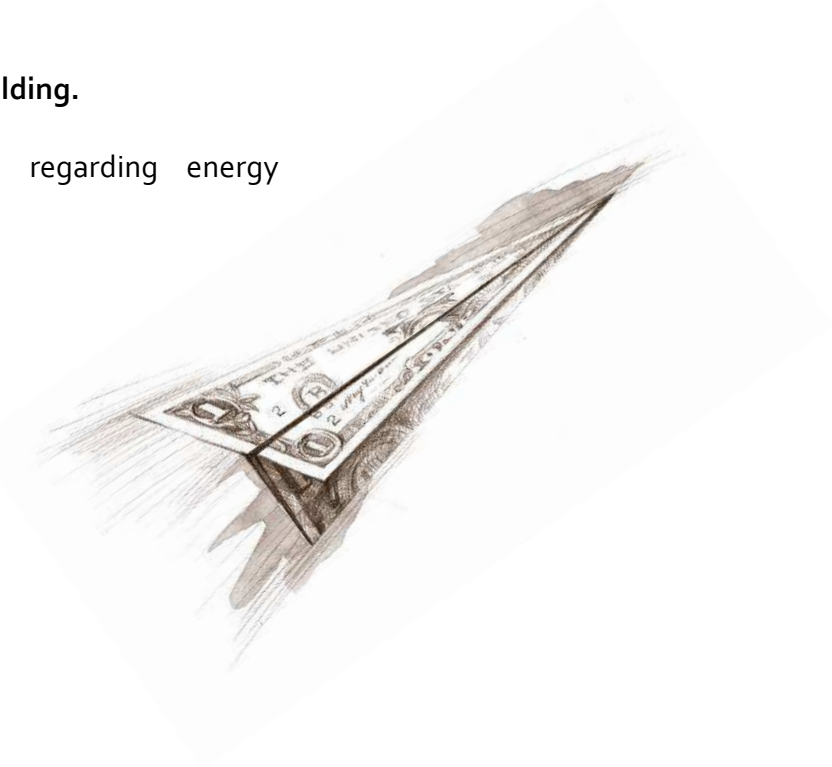
Instilling good habits in the workplace will transfer them into the daily life of that person. Good practices in your building can have secondary effects on the society as a whole, the domino effect of good practices for social change.

✓ **Improved public image = proud employees and better public image**

It is important for public buildings to serve as an example. When a citizen walks into your building it is important that they feel their government is responsible. Likewise, it is important to transmit the benefits to workers so that they have a shared sense of pride that will be transferred to their work.

- ✓ **Increase value of the building.**

There is growing legislation regarding energy efficient buildings and laws are being passed in many countries regarding the requirements on sales and rentals of buildings. The value of the building is obviously greater and the possibility of sale higher of an energy efficient building.



3. Is it right for our building?

The answer is an astounding **YES**. Whether you have a small budget or no budget at all, energy efficiency is the way to go.

Funds should not be the deciding factor to not embark on a road to energy efficiency. On the contrary, Energy efficiency can often be a solution to financial weakness. Keep in mind that 30% of the total energy spent at many of our desks is lost as a result of misguided practices. Therefore, the first step and the most economic solutions are found in changing behaviour and not equipment.

However, it may be easier to change a light bulb than the practices of someone who is not on board, but management can make it happen with commitment, the right knowledge, planning, patience and a positive attitude.

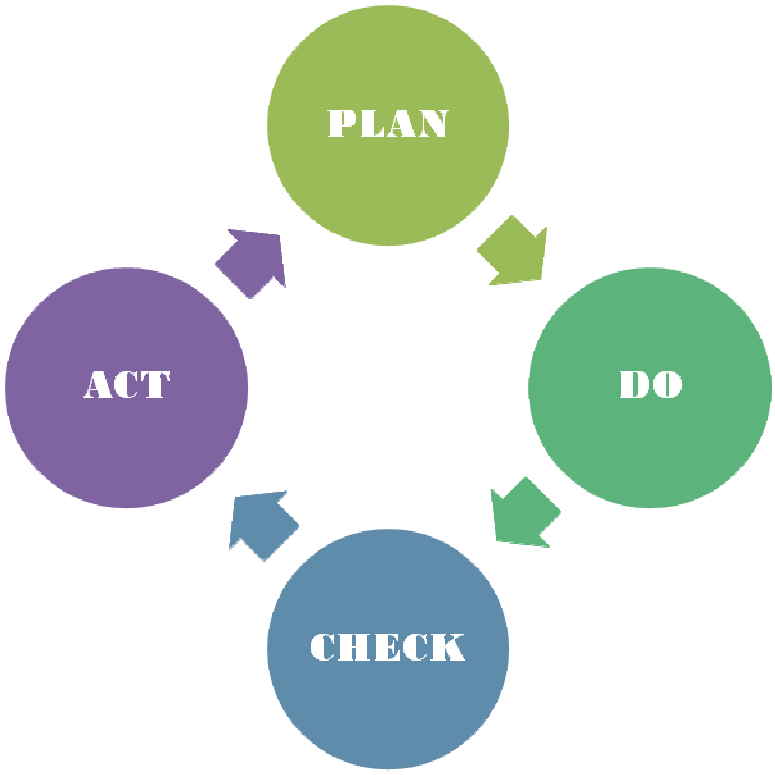
On a small budget simple changes in light bulbs and power strips can offer a large savings over time. For example a LED bulb uses one fourth of the energy an incandescent bulb uses and needs to be replaced much less. As prices decrease on LED bulbs, the need to change luminaries becomes more and more evident.

Thanks to Energy Service Companies (ESCO´s) and other financing bodies can confront even larger retrofitting projects like changing pumps, heating systems, installing solar panels, and appliances that can have a high initial investment but can offer many benefits: economical, environmental and health. These changes should have a proper cost analysis prior to purchase but can be very cost effective over time. ESCO´s can help in determining the payback period and best options.

EPLACE services will also help measure where the most effective changes can be made (see section 4.1).

4. Energy Management System

So how do we get a programme started and keep it going? The Energy Management System (EMS) puts it plain and simple: PLAN-DO-CHECK-ACT.



EMS *"is a set of interrelated elements to establish an energy policy and energy objectives and processes and procedures to achieve those objectives"*

A good plan starts by showing commitment that stimulates participation. It identifies obstacles, limits, budgets, resources, timelines and goals. It also establishes baselines, strategies, methods of monitoring and an effective reporting system. This sounds like a lot but this manual will give you some easy to use tools needed.

Test the plan by using the resources identified in the planning process, prepare reports and implement a communication campaign. Use best practices. Implement resources and support workers responsible for energy savings tasks.

Analyse performance of the measures taken against the desired outcomes. Determine improvements as well as readjustments and modifications that need to be made. Recognise achievements.

Implement the plan with the improvements, readjustments and modifications. Restart the cycle continuing with improvements and modifying areas for improvement.

4.1 PLAN: How to get started?

In order to start planning we need to have a good grasp on the current situation. In other words we must determine the "who", "what", "when", "where" and "how" of energy spending.

The tools of EPLACE, the Intelligent Energy Saving Account (**IESA**), **WeLight, WeSave** and **WeTalk** will also help you get started in identifying where changes need to be made and will offer support in efforts.

The **IESA** is an online platform that gathers and analyses results and offers recommendations. It is composed of:

- Advisory tool
- Pumps check
- Heat protection
- Solar Check
- Cooling check

WeSave is a smart energy monitoring and control system that follows a building´s energy use

WeLight is a smart system that follows the energy of exterior lighting.

*Smart meters are instruments that are **S**elf **M**onitoring **A**nalysis and **R**eporting **T**echnology.*

WeTalk is a collaborative platform and social network to provide support to participants.

4.1.1 Who: Committed top management and employees with a voice.

The level of commitment from top management's or its equivalent is key to a successful programme. They have the responsibility to commit to support the programme and improve its effectiveness (ISO 50001, 4). If there is no commitment from the top, you can be certain there will be no action from the middle down. Too many times we hear phrases like, "*The boss doesn't care. Why should I care?"* or *"It will all change next month*".

Commitment needs to be shown in writing as well as demonstrated in actions. As an example of best practice you will find a written policy attached in **Annex 1**. Having a written policy not only shows commitment it also helps to organise a top notch programme. To ensure that the policy is current and functioning to its optimum level, it should be reviewed regularly and updated as necessary.

Great! You made the leap, the administrators are on board, the writing of a plan is in its draft phase but now the administrator left the light on in the bathroom! Three people saw it happen and the word is starting to spread quicker than light from a LED! Since we expect that workers will do their best to follow best practices it is even more important that we remember to serve as a model and do the same.

> *Our character is what we do when we think no one is looking."*
>
> - H. Jackson Brown

Some good points to follow are discussed in the International Standard 50001. For example it states that top management must also provide the resources needed to establish, implement and maintain programmes. So often we have high expectations however, if we don't provide the means to achieve them, it only amounts to frustration and in the end apathy.

Giving public workers the chance to voice their opinion will provide a free consultation on energy use and will give top management the opportunity to get to better know employees. Perhaps the management already is well involved with their employees however; we have taken the liberty to include another best practice document, a **sample questionnaire** (**Annex 2).** Since workers spend many hours in the very place we want to save energy, they can often be a very important asset for improvement, providing many ideas on how and where change can be made. When workers feel like they are part of the solution, they are more likely to take pride in participating, making a programme a sustainable, long-lasting one. This employee satisfaction can also be transmitted to an improved working environment where voices count, proving to be positive on many levels. A happy employee is a productive employee.

Compiling baseline information regarding employees will also help determine the types of training and awareness programmes that will be necessary to improve the situation (ISO 50001, section 4.52).

A baseline is a quantitative reference that provides a basis for comparison of energy performance (ISO 50001).

The WeSave device and EPLACE platform will provide information to staff and management to allow compile a baseline reference for energy use and to identify savings opportunities. Staff can get engaged in energy efficiency through monitoring usage, suggesting energy saving projects and monitoring the savings using the EPLACE platform.

For example, different areas within a building could take part in an out of hours usage reduction competition and share experiences using the WeTalk platform.

> ""*The way you see people is the way you treat them, and the way you treat them is what they become."*
>
> -Johann Wolfgang von Goethe

Apart from getting worker opinion we need to decide who is going to carry out some of the basic tasks of putting the programme in place. We must create positions like energy managers, buyers, campaign communicators, etc and define tasks and timeframes for actions. These energy pioneers also must have the know-how to carry out their job. So if they are not fully equipped with experience perhaps it is a good idea to get some outside help to train them.

4.1.2 What, when and where: an assessment of the current situation.

- ✓ **What and when is it being spent?**

Get out all of the bills paid for energy in the last years and fill out the record provided in the best practice document, (**Annex 3**). Not everyone keeps data for more than a year so fill in as much as possible. Seeing what is being spent will help determine where important savings can be made and will serve as a baseline for future spending.

Initial calculations can be affected by many variables such as weather, production level, etc. Many professional auditors and ESCOs will take these calculations when performing audits. Baselines are said to be normalised when these variables are removed from the equation.

- ✓ **Where is it being spent?**

A walk through will help you identify where the energy is being spent, this includes all the electrical appliances that are plugged in to an outlet or to the circuit breaker and all equipment that needs fuel (gas, oil, biomass, etc) to function. If a map of the building is available it can serve as a good tool to make sure you do not miss any small rooms. You may get a little dusty so put on some older clothes.

This is an auditor, building manager or ESCO´s job but getting familiar with your building will help you prepare for their visit.

You will want to be aware of the number of any given devices or appliances, whether it is switched on at the power source, the number of hours it is used each day and whether it is used seasonally or all year long.

The best practice document (**Annex 4**) for this task is a short list to help you get started on thinking of where the energy in you building is being spent.

Data from the WeSave will provide a breakdown of electricity use and allow specific uses to be identified and monitored.

4.1.3 How: Investigating our options and challenges.

BEST PROCUREMENT POLICIES ***(Please see Annex 6 for more details)***

Good procurement does not just help the company save energy and money but it also reduces environmental impacts, and stimulates social improvements (like fair trade) and creates incentives for the continual growth of the market for energy efficient products.

To support the initiative, the European Commission established the "Green Public Procurement. GPP is a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary.

Their (http://ec.europa.eu/environment/gpp/index_en.htm) get down to every last detail and presents information on legal framework, fact sheets and guides that can further assist on Public Procurement.

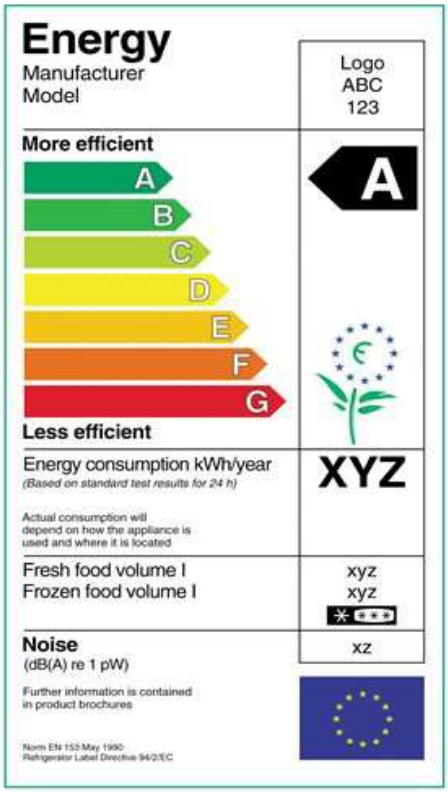
Among these is the Managing GPP Implementation Reference document. This document explains in depth the management model, stating that an effective management system aims to ensure a systematic management support and supervision, provide clear tasks and responsibilities for those directly involved, appropriately monitor progress, achievements and problems and lastly to ensure continuous improvement.

However, here we are going to try and keep it simple and just name a few things to keep in mind when purchasing:

- ✓ **Benefitting from the Energy labels.**

Energy labels help consumers choose products which save energy and thus money. They also provide incentives for the industry to develop and invest in energy efficient product design. The ultimate aim is that manufacturers of energy-using products will, at the design stage, be obliged to reduce the energy consumption and other negative environmental impacts of products. While the Directive's primary aim is to reduce

energy use, it is also aimed at enforcing other environmental considerations including: materials use; water use; polluting emissions; waste issues and recyclability.



The recast Energy Labelling Directive: Directive 2010/30/EU was adopted by the European Parliament and Council in May 2010. It extends the energy label to energy-related products in the commercial and industrial sectors.

The extension of the scope from energy-using to energy-related products (including construction products) means that the Directive incorporates all equipment that has any effect on the use and conversion of energy. The products may not consume energy however they may "have a significant direct or indirect impact" on energy savings such as window glazing and outer doors.

Energy labelling requirements are already in force for a number of products and the Commission will adopt delegated regulations for energy labelling in parallel with the adoption of the EcoDesign regulations.

- ✓ **Look for Energy Star**

The Energy Star label represents a level that any environmentally conscious manufacturer will want to meet. The Energy Star database that lets you pick the most energy efficient models, within the group of Energy Star qualified office equipment, which meet your performance criteria. Background information and hints on why it makes sense to buy the most energy efficient office equipment, how to select the most energy saving configuration and how to use it most efficiently.

This Energy star is a coordinating initiative between the European Council and the United States Government.

According to the new Energy Labelling Directive, the layout of the energy efficiency label gives room to up to three new energy classes to reflect technological progress. The energy labelling system initially ranged from A to G. The new Energy Labelling Directive introduces new efficiency classes to coincide with improvements in

technology in recent years. These help to differentiate between the top end of the scale. Now we use A+, A++ and A+++ on top of the existing A grade for the most energy-efficient household products. The most efficient class is represented by A+++.

The labelling colour scheme will be adjusted accordingly, so that the highest energy efficiency class will remain dark green and the lowest energy efficient class will be red. The new label will gradually be introduced at the point of sale. Consumers are likely to see the old and the new label alongside. Still, it is possible to compare the products since an old class "A" appliance is still equivalent to a new class A appliance.

- ✓ **Get the right size**

The answer is yes to the life-long question. Size does matter when choosing lighting, heating, air-conditioning, pumps, etc. It is natural to think bigger is better however in energy efficiency it can cost you some extra cash.

In lighting for example, it isn't the quantity of light bulbs you have installed but rather the intensity of light that needs to be considered. Likewise, when air conditioning and heating units are being considered, one must consider the volume needed to be acclimated and not just choose the cheapest or most efficient.

Size also matters during comparison. So when comparing two appliances, compare labels of similar sized products

- ✓ **Use natural gas instead of electricity**

Switching to natural gas can cut your energy bill in half. According to information from Europe's Energy Portal (www.energy.eu), energy from natural gas is often less than half the price per kWh of energy from electricity. *Just be sure to watch for extra fees for services from providers before making that switch*.

You can feel good about changing to natural gas because natural gas hot water heaters can use up to 29% less energy, equating to less CO_2 emissions, and a little more change in your pocket. Feeling good? Well feel a little better, because during the process of electricity production about 60% of the total initial energy input can be lost during its production and transmission where, as natural gas has very little loss in transmission.

- ✓ **Think long term**

Many savings will not be seen right away so careful attention must be taken to calculate payback periods. Perhaps in the first year we will not see savings but in the second and third years we will see spectacular results.

- ✓ **Think of how long that item had to travel**

We got a great deal on some led lights but we failed to look where they were made. They travelled, the seven seas, then by across Siberia by rail, by truck and then in our own cars to make it to our office. Meanwhile, if we had looked a bit further we would have found the same priced led from a factory in our own country that would have needed one third of the energy to be transported.

- ✓ **Could you buy it locally or nationally?**

We have heard the phrase over and over. Act locally, think globally. Buying local stimulates our country's market for energy efficient products, feeds our economy and reduces energy in transporting products.

A list of national Energy Efficiency Resources can be found in the annexes of the EPLACE deliverable D3.5 "***Guide to Energy and RES Services***".

In addition, we have provided a Tip sheet for buyers of energy efficient technology. This document provides specific information on what to look for when buying appliances or other products (**Annex 6).**

- ✓ **Choosing an installer**

A university professor, an environmental lawyer whose specialty was in environmental home inspections, once told me you do not get what you deserve but rather what you bargain for. I have taken that lesson to heart. You cannot go into a negotiation blind and think you will come out on top. You must do your homework. Here is a tip sheet to help you begin.

New, more efficient and renewable energy systems can save us money in the long run however their installation can often be costly. Also if it is not installed correctly, the

equipment will not be as effective or could have a shorter life. So don't go with the cheapest installer, go with the best. It is worth the investment.

The tip sheet in Annex 9 will help you make the right decision.

SUMMARY OF BEST PRACTICES *(Please see Annex 7 for more details)***:**

The following practices listed are just a short summary. In **Annex 7** of this document more detailed information is described.

General

- You cannot control what has not been measured. Install measuring instruments like the one from EPLACE will help to provide a baseline and define when improvements can be made.
- When possible and appropriate incorporate renewable technologies into the building.
- Install programmable thermostats to regulate temperature.
- Turn it off if it is not in use.
- Use stickers and posters to remind building users and employees of good practices.
- Lower hot water thermostats to 49°C.
- Beware of energy vampires. These are devices that although they are turned off are still plugged in. Do not be fooled, they are still using small amounts of energy that can add up to a lot of energy so make sure to unplug or turn off the circuit breaker or power strip.
- Check that all windows and doors are closed when using cooling or heating systems.
- Look for Energy Star and A rated products.
- Carry out annual maintenance, read instruction manuals and hire professionals for installation and start up of equipment.

Lighting

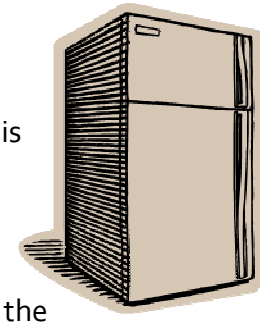
- Install light dimmers to control light intensity
- Substitute incandescent lights for compact fluorescents or LED lights. You can save up to 80% of the energy.

- Use sensors in areas not always occupied and in hallways and stairways.
- Take advantage of natural light and use light colours to paint the walls and ceilings.
- Instruct employees on turning off electronic devices that could otherwise be left on.
- Keep lamps and screens as well as windows clean to increase lighting.
- Adjust lighting to needs, using spot lighting to concentrate the light only where it is needed.
- Use LED solar lights for exterior areas. Just one more reason: LED lights do not have UV rays so they do not attract insects.

Air conditioning and heating

- Choose appliances and systems that are energy certified by entities like Energy Star or ECO label.
- The installation of energy efficient air conditioners can consume up to 60% less than other units.
- Use shading devices like awnings, blinds, curtains and plants to keep sunlight out and minimize the accumulation of heat. (This can be reversed in the winter months).
- Keep the temperature around 21ºC.
- Dirty filters restrict airflow and can cause the system to run longer, increasing energy use. Replace filters monthly for maximum benefit. (Save: 1-2 percent).
- Install windows with good insulation
- Keep units in the shade with good air circulation
- Make sure everyone is comfortable. Ok almost everybody. Many times if someone is not comfortable, they will look for a solution that is often not energy efficient (opening a window, plugging in a heater).

Kitchen appliances



- Purchase A rated or Energy Star appliances
- Inform staff on water saving. Remember hot water is energy spent.
- Have a system to report leaks and fix them as soon as possible.
- Check equipment temperatures and flow rates. Use the maximum water savings flow rate and the minimum temperature according to manufacturer guidelines.

- Make sure appliances that produce heat are separate from those that cool.
- Ensure that there is space behind the appliances for air to circulate.
- Defrost items by placing them for a few hours in the refrigerator, avoiding doing it by running water over the item.
- Cooking equipment and pots should adequately fit the burner flame.
- Cover pots, casseroles and pans.
- Turn off heat producing appliances (electric pots, grills, etc) before finishing using them to make use of residual heat.
- Keep ovens, grills and stoves clean.
- Keep oven doors well closed and reduce the temperatures of preheating.
- Use the dishwashers only on full loads and use economic programs or ones with low temperatures.
- Hot items should not be placed in refrigerators nor should refrigerator or freezer doors be left open without need.
- Avoid ice build-up or condensation in the refrigerator units.

Energy production

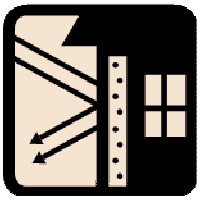
Energy production technologies can provide a cheaper and more sustainable source of energy than conventional fossil fuelled sources. They tend to involve a significant expenditure so buyers should carefully research their energy needs and suitable technologies before investing. Technologies include, small scale wind, solar p-v, solar thermal, biomass boilers and CHP. When considering investing in any of these technologies you should consider the following.

- Carry out a site assessment to check the energy demands and the resource and suitability for a technology. What's the wind resource? Is there a suitable unshaded area for solar? Is the heat demand suitable for CHP or biomass boilers?
- Check that all items of the equipment/system considered are CE marked[1]

[1] http://www.certification-experts.com/certification/general-information/

- Check that equipment complies with the relevant standards and have certified performance test reports.
- Where relevant check for independent accreditation and certification systems. These include, for example, solar keymark, TripleE in Ireland, MCS or ECA in the UK.
- Check operating and maintenance manuals
- Carry out a financial analysis and feasibility study to determine costs, revenues and paybacks.

Insulation



Retrofitting insulation to a building can be an invasive and costly exercise. However the payback on energy costs is often quite reasonable and improved insulation will lead to improved comfort levels. In some extreme cases it can save up to 90% on heating.

Depending on the type of roof, it can often be quite straightforward to insulate at roof level.

Insulating flat roofs can be more difficult and requires some structural work. Insulating walls also usually needs some building work finishing, plastering and painting internal walls if insulation is applied internally finishing and painting external walls if applied externally.

If arranging for insulation you should ensure that the insulating material and the contractor are certified by relevant bodies. For example, in Ireland, insulation contractors and material are certified by the Irish Agreement Board while in the UK the British Board of Agreement provides this service. (see Annex 9 Choosing an Installer).

Building envelope

The building envelop is the outer shell of your building. Ensuring the insulation is in good condition and that there are not air leaks in your building.

See the tip sheet in Annex 9 to get started.

Windows

Of all the components in a building, it is through the windows that most heat is lost. This is because glass allows heat to escape more readily than most other building materials.

For example, given the same area of wall and window, the window will allow up to eight times more heat to escape. For this reason, it is important that your windows are as efficient as possible.

While standard double glazing is a great improvement over single, even more advanced glazing systems are now available on the market at affordable prices. Two examples include gas filled double glazing and low emissivity glazing.

In gas-filled double glazing the cavity between the two panes of glass is filled with an inert gas (usually argon) which conducts less heat than air, therefore improving the window's energy efficiency.

Replacing windows is generally expensive and is usually only worth it if the windows are draughty and single glazed. You should ensure that new windows have as low a u-value as your budget allows (good quality double glazing will give a u-value of 1-1.5). The window should be certified to a relevant test standard or should have an energy label (eg http://www.bfrc.org/).

Transport and vehicles

A man who owned a lorry company began to suspect that one of his drivers was stealing fuel from him. He began to compare the two drivers who travelled an identical route. One was spending almost a third more of what the other had spent on fuel. Before accusing his employee falsely he carried out a careful inspection and he realized there was no double handed driver, just poor driving habits, an old lorry, and differences in vehicle maintenance. A simple course on good driving practices and tips on lorry maintenance could save him thousands per year. Reading through the tip sheet in Annex 9 can also help to save you money and wear and tear on your vehicle.

Here is a short over view:

Maintenance:

- ✓ Tyres properly inflated. Maintaining your tyres inflated is an easy task that can improve your mileage by 3%
- ✓ Use proper grade of motor oil can save 1 – 2 % on gas mileage
- ✓ Replace dirty Air Filters (in older cars this matter more)

- ✓ Tune up can save up to 4% on gas mileage.

Driving tips:

- ✓ Choose the right vehicle
- ✓ Take it easy. Speeding decrease fuel economy
- ✓ Using the cruise control can save by maintaining a constant speed
- ✓ Avoid carrying unnecessary loads. Losing the roof rack or items in the trunk can reduce mileage by 5%.
- ✓ Turn down the air. Air conditioning set on the maximum can reduce the mileage by 5-25%.
- ✓ Avoid idling. Although you are not moving, idling is using fuel.
- ✓ Try to travel during off peak hours
- ✓ Consider other means of transport or combining types of transport
- ✓ Combine trips
- ✓ Use overdrive gear
- ✓ Motorcycles

DETERMINE THE ENERGY PERFORMANCE INDICATORS

According to the ISO 50001, Energy Performance Indicators (EnPIs) can be a simple parameter, a simple ratio or a complex model. Examples of EnPIs can include energy consumption per time, energy consumption per unit of production and multi-variable models. The organization can choose EnPIs that inform the energy performance of their building and can update the EnPIs when business activities or baselines change that affect the relevance of the EnPI, as applicable.

Energy Performance Indicators (EnPIs) for the EPLACE project were identified as part of the survey and data collection for the Pilot Buildings Energy Assessment report (D2.4). Indicators may be on an annual basis or may vary over time (eg kWh/month defined for each month of the year). Similarly EnPIs may relate to total energy consumption or energy consumption for a particular end use such as lighting.

The availability of energy usage data is key for the establishment of useful and accurate EnPIs and the usage data collected from the measurement components of the EPLACE solution (WeSave and WeLight) will allow the identification and refinement of Energy Performance Indicators.

However; the most important indicators used to define and compare buildings in the EPLACE project are the following:

EnPIs
Overall specific energy use – kWh/m²/year
Electricity use (excluding electricity for heating) – kWh/m²/yr
Energy use for heating – kWh/m²/yr
Energy use for heating – kWh/m²/HDD
Overall specific energy use – kWh/m²/week or month (this will allow ongoing monitoring of performance but will require adjustment for independent variables such as weather – heating degree days)
Electricity use for lighting kWh/m²/year-week-day
Energy use for cooling – kWh/m²/CDD
Electricity use for engineering services kWh/m²/year-week-day

Heat and cooling degree days should be considered in these calculations. A degree day is a unit used to relate the day's temperature to the energy demands of air conditioning or heating.

DEFINE STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS

What are the benefits and roadblocks to achieving project goals?

Before you can establish your action plan, a SWOT analysis can be very helpful.

This simple analysis method helps to establish the **S**trengths and **W**eakness, **O**pportunities and **T**hreats of any project.

Being realistic from the beginning can help solve problems before they arise and take advantage of strengths, amplifying their success.

> "Everyone wants to be appreciated, so if you appreciate someone; don't keep it secret."
>
> – Mary Kay Ash

An example of a SWOT analysis for an energy programme could be the following:

	HELPFUL **to achieving the objective**	**HARMFUL** **to achieving the objective**
INTERNAL ORIGIN	**STRENGTH** • Reduced energy costs • Increased economic strength, improved company portfolio • Healthier environment • Improved working environment-comfort, happy workers • Energy security, lower dependence on outside energy sources	**WEAKNESSES** • Initial financial investments • Waste management of old materials • Extra work hours needed to find manufactures and for installation • Inconvenience or stop in work • Continual effort and commitment * ***Changing worker behaviour***
EXTERNAL ORIGIN	**OPPORTUNITIES** • Increased value of property • Lower emissions, environmental conservation • Possible tax breaks • Improved business image • Serve as a model for the community • Regulation compliance	**THREATS** • Risk of investments no having the payback desired • New, better technology • Risk of malfunction of technology or repair costs

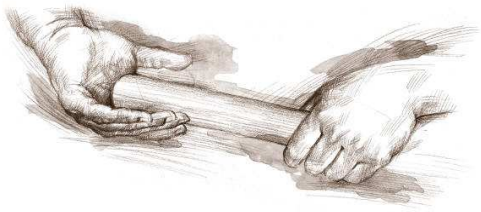
In the long run we hope to save money but we must admit that for some projects money and time is a major player in getting started. To learn more about financial services in your country consult the EPLACE, ***First Guide to Financial Services.*** It contains sources on ESCOs and other financial supporting bodies and mechanisms.

However, as clearly stated in the SWOT analysis, the number one weakness to any energy efficiency programme is one that will cost very little to no capital at all: the human component of **changing behaviour and attitude**.

According to the document "***Managing Change**: **A guide on how to manage change in an organisation***" written by Envirowise & the Government Office for the South West (UK) there are four key factors to be considered:

1. **Pressure for change.**

The pressure for change may originate from new legislation, saving money or other causes but the management must be behind it fully supporting and committed to the change.



2. **A clear, shared vision.**

Effective change is change that is consistent at all levels of the organisation. All involved must be clear on the objectives and be motivated to meet them. Motivation starts with pride, happiness, responsibility, observed success and recognition of efforts.

3. **Capacity for change.**

The resources and finances must be provided to achieve the change.

Time must be given to staff and sometimes funding so that change can be implemented. Remember that employees are often the ones to have information, intuition, ideas and instincts needed to make improvements that can save costs and increase efficiency.

4. **Action.**

There must be a plan to be implemented and employees must be informed on its aims and progress. Most importantly workers must be reassured that the change is a good one. Find what motivates people. Perhaps it is money or the idea that the savings goes to a foundation, organisation or building improvement.

DEFINE PHASES OF BUILDING UPGRADES:

After completing the SWOT analysis and change behaviours is addressed, building upgrades can be planned. The Energy Star Building Upgrade Manual establishes the following stages of the **integrated upgrade approach**:

1. Retro-commissioning:

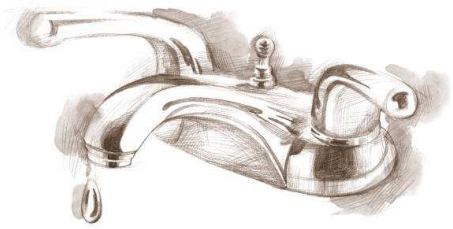
First and foremost we must determine the problems in the overall building. Retro-commissioning aims to improve the way the equipment and the systems of a building function. Retro-commissioning seeks to solve problems in the original structure or issues that have arisen over time to enhance overall building performance.

Retro commissioning is commonly performed by professionals like ESCOs. The EPLACE services (IESA, WeSave, WeLight, WeTalk) will also help establish the improvements

2. Lighting:

Lighting often consumes close to 35% of the electricity in buildings and can be a good place to start. Lighting that can produce or reduce heat can also affect other systems in the building like heating and air-conditioning. Since it is an important building block it should be considered at the beginning of any project.

3. Supplemental load reductions:



Supplemental loads are those loads produced secondary to the real need for energy consumption. The sources for supplemental loads are people, computers, lights, and the building itself. For example a person who leaves their computer running when not in use. These loads can affect other systems like heating, cooling, and electric loads. These loads can be reduced by reducing energy use by office equipment, upgrading the building envelope to better manage heat flow and installing a properly sized, and energy efficient HVAC system.

4. Distribution systems

The distribution system circulates air and water through the building. As in all systems, the distribution system needs to be tested, balanced and cleaned.

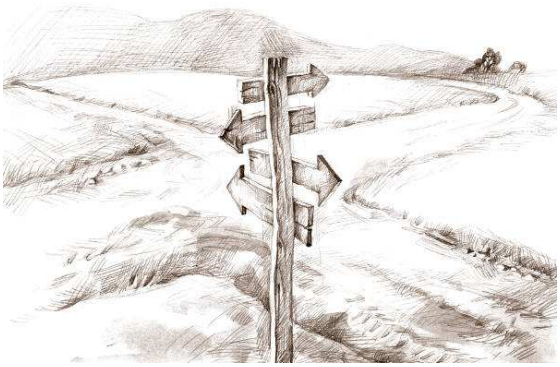
5. Heating and cooling systems

Since over time thermostats and temperature sensors are reset by uncomfortable employees or become a bit out of tune, they must be re-calibrated. The devices also need monitoring, maintenance and scheduled tune ups.

CHOOSING AN INSTALLER:

See Annex 9 to learn how to choose an installer.

4.1.4 WRITING A PLAN



"If you don't know where you are going, any road will get you there."

- Lewis Carroll

Now that you have done some research you can start putting the **PLAN** to paper.

Take a deep breath and before starting ask:

- ✓ Where are we currently and where would we like to be?
- ✓ What level of commitment do we want and can we assume?
- ✓ What degree of effort are we willing to make (economic, personal, and organisational)?
- ✓ What is our timeframe for action?

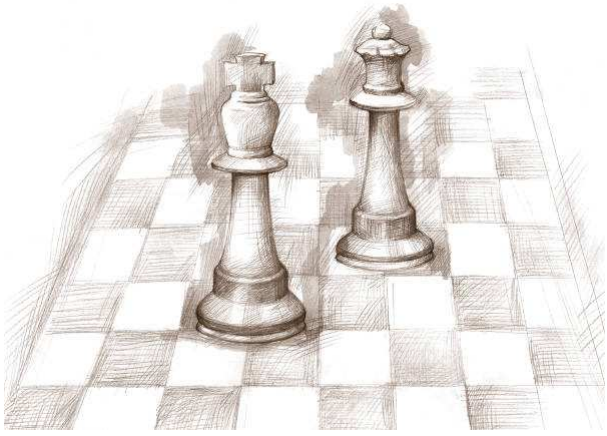
Important points to keep in mind when writing the plan:

- ✓ It should be believable.
- ✓ It should be coordinated with other company policies and with legislation
- ✓ It should be clear and decisive so that it is easily understood by all readers
- ✓ It should include a comprehensive plan to educate building users.
- ✓ The set goals and responsibilities should be viable and well defined
- ✓ It should be communicated to all people in the organisation
- ✓ It should consider continual improvements.

See ANNEX 6: Company Energy Plan Template

4.2 DO: Test the plan

"If we knew what it was we were doing, it would not be called research, would it?" - Albert Einstein



Implementing the plan does not mean we can just wash our hands of everything. At this stage of the game, the implementation of the plan is a trial period for "research" to test the effectiveness of our plan. Once the plan has been implemented we can then **CHECK** what needs to be modified and **ACT**.

Once the cycle is completed, it should be started again.

Use of the EPLACE services will help to monitor progress and challenges as well as motivate all participants to improve efforts during the implementation process.

Good luck!

4.3 CHECK

A check must be done on a regular basis in order to improve and fix problems that may occur during the implementation of the programme. The following steps can be taken to evaluate your progress:

1. Check your EPLACE account for results.

See the results of your building after a 6 month period. What could be better?

2. Fill out the building information and energy consumption sheets (Annex 3) again and compare your data from the past years.

Did you save energy and money? If not, why not?

3. Give building users the second questionnaire (Annex 12) and see if attitudes and behaviours have changed.

If nothing has not changed, why not? What needs to be done to help further change attitudes and behaviours?

4. Review timelines.

Are the tasks set out to do being accomplished on time?

5. Check goals.

Are the goals that were set at the planning stage being reached?

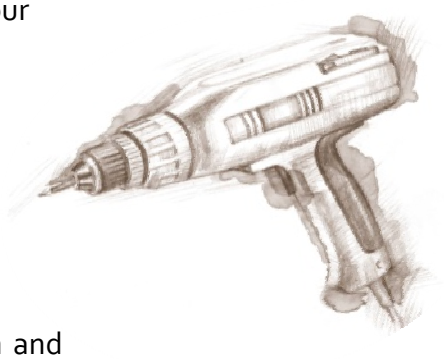
6. Reward hard work and achievements.

It is important that efforts are recognised. Acknowledging behavioural changes in the workplace can motivate employees to keep going. (**see Annex 10**).

The EPLACE platform and WeSave device will allow EnPIs (Energy Performance Indicators) to be routinely monitored to check on energy performance against the planned targets. Savings are sustained by continuously checking use and improved performance improves staff motivation and leads to further and deeper energy savings.

4.4 ACT: Adjust it, change it and do it!

Come on and own your plan to make it suite to your needs. So modify, mould it into what you need and implement the plan with your tailored changes.



Using the results from the checking process detailed in the previous section, modify the plan and establish new goals.

Once these are determined, revise the written plan and add the modifications. Please communicate these changes to employees and all individuals and groups involved. Unless you are in the Caribbean, it is no fun for anyone on a bus en route to an unknown destination.

Now **ACT**. Implement the new plan. Remember to periodically revise the plan again to make sure technology has not improved or become outdated or remediate small problems that may arise over time.

In the case of EPLACE we recommend that every 6 months this cycle is completed.

> "You may have to fight a battle more than once to win it."
>
> -Margaret Thatcher

5. What are the others doing?

Best practices summaries from EPLACE pilot sites have been included in **Annex 11.** In this manual (the 1st of three) you can see the progress being made and the lessons being learned.

These EPLACE pilot sites include:

Ireland- Dublin

- Tallaght Library,
- FINGLAS leisure Center

Bulgaria- Septemvri

- Administrative building of the Municipality of Septemvri
- Medical Centre

Spain- Cartaya

- City Council
- Cultural Centre of the Town
- Guadalinfo Telecentre

See Annex 11 for details

6. ANNEXES: MY TOOL BOX

ANNEX 1: Sample statement

[Date]

COMPANY ENERGY MANAGEMENT STATEMENT AND POLICY

The company understands it has a responsibility to its employees to improve the workplace environment, to citizens to manage funds wisely and to future generations to help protect and preserve our environment and its natural resources. For this reason, we have developed a company Energy Management Policy that will help following through with this commitment. We ask for your participation and support in our efforts as a company.

This Energy Management Policy aims to:

- Increase energy efficiency within the workplace
- Reduce our carbon footprint
- Reduce dependence on fossil fuel
- Reduce emissions of CO_2 & harmful greenhouse gases
- Create a healthier work environment
- Inspire company workers and stakeholders to improve our environment
- Act as a model for companies, agencies, citizens, etc
- Create a smart budget and eliminate unnecessary costs
- Develop a fabulous public image
- Increase our pride in where we work

SPECIFIC PROGRAMMES

Heating & cooling:

- Example: Hot and cold water machines throughout the company are all energy efficient models featuring sleep modes when not in use.
- What has been done?

Lighting

- Example: All lights are switched off at 9.30pm unless there are staff working in that particular area.
- What has been done?

Computers and IT

- Computers have a standard energy saving image that enforces screensavers and sleep mode in the most energy efficient way possible – screensavers start after 5 minutes inactivity, screens enter sleep mode after 15 minutes inactivity, computers sleep after 30 minutes inactivity.
- What has been done?

GOALS AND TIME FRAMES:

Medium term: (Examples include)

- Implement all practical cost effective energy efficiency measures
- Identify further opportunities to make more efficient use of energy and water
- Provide regular management reports on cost, consumption, performance changes and improvements
- Educate building users on best practices
- Motivate all site users to avoid waste and use energy more efficiently and encourage staff to suggest new ideas for improving energy efficiency

Long term: (Examples include)

- Give high priority to energy efficiency investments
- Increase our investment in clean, efficient technologies

Energy Management team:

- Name and responsibility
- Name and responsibility
- Name and responsibility
- Etc.

What we have already accomplished:

This is to be added once you have gotten started to show improvement. It can include serious things like graphs or even a picture of something that has really changed.

> *Never doubt that a small group of thoughtful, committed people can change the world. Indeed, it is the only thing that ever has.*
>
> -Margaret Meade

Signed

CEO

Company

Address

ANNEX 2: Employee Energy Questionnaires

Questionnaire 1 : Prior to programme implementation.

Dear Employee,

We are proud to announce our new efforts to save energy. In the next months to come you will notice that we are trying to make some beneficial changes. Since each one of you holds an important piece to this puzzle, we turn to you to offer insight and guidance on the current situation and to give your input on how we can all improve. By bettering our energy use we hope to increase the comfort level in the work place, have a reduced impact on the environment and global warming, and reduce company spending to create an even stronger company.

Thank you for taking the time to fill out this short questionnaire.

1. How would you define the overall attitude in the work place?

Very positive and active	☐
Positive and aware	☐
Somewhat aware	☐
Neutral	☐
Indifferent	☐

2. Are you motivated to save energy in the workplace?

Yes, most definitely	☐
Yes, somewhat	☐
If the company wants it, I'll do it.	☐
It is not something that gets my engine revving	☐
Indifferent	☐

3. Would you say our energy use has an environmental impact?

Yes, most definitely	☐
Yes, somewhat	☐
We have a neutral impact	☐
Not to the extent some think	☐
Indifferent	☐

4. Would you say our energy use has an impact on company spending?

Yes, most definitely	☐
Yes, somewhat	☐
We have a neutral impact	☐
Not to the extent some think	☐
Indifferent	☐

5. Do you think the company could do more to save energy?

Yes. A lot more	☐
Yes. There are some things we can change	☐
I think we are doing fine	☐
I don't see my opinion as important.	☐
Indifferent	☐

6. Do you practice energy saving methods when at work?

For example:

Do you turn off the lights upon leaving if you are the last one in the office?
Do you turn off the lights in the bathroom upon leaving?
Do you turn off your computer and the screen at lunchtime and at the end of the day?
If you have a space heater do you only use it when necessary?
Do you opt for opening a window instead of using air conditioning?
In the break room, do you unplug microwave when finished using it?

Yes. As much as I can	☐
Yes. When I remember	☐
On an occasion	☐
No. It´s not my priority.	☐
No. Honestly it just doesn't occur to me.	☐

7. Will you use these energy saving methods at home?

Yes. As much as I can	☐
Yes. When I remember	☐
On an occasion	☐
No. It´s not my priority.	☐
No. Honestly it just doesn't occur to me.	☐

8. Are you interested in getting involved in the company´s energy savings programme?

I´d take an active roll	☐
I´d help out if I can	☐
I´ll do what is asked but I cannot do much else	☐
I have enough to do, thank you.	☐
Indifferent	☐

The opinions of the employees are an important source of information on how to improve our energy practices. Please detail any ideas you may have on how we can save energy and what would motivate you to save.

Thank you for your time to care about our company

Questionnaire 2: After trial period of 6 months.

Dear Employee,

Once again we ask for your assistance in our energy programme. The programme has now been in place for some months and we would like your opinion on how it is going. Please take a few minutes to tell us what you think.

1. Has the overall attitude in the work place changed?

Definitely yes.	☐
Yes, somewhat.	☐
Yes, a little.	☐
It has stayed the same.	☐
It has gotten worse.	☐

2. Are you more motivated to save energy in the workplace?

Yes, most definitely	☐
Yes, somewhat	☐
Yes, a little.	☐
I am still indifferent	☐
I don't make an effort	☐

3. Has your opinion on energy use and its impact on the environmental changed?

Yes, most definitely	☐
Yes, somewhat	☐
Yes, a little.	☐
I have stayed neutral	☐
No. What is all the fuss about?	☐

4. Have you seen an impact on company spending or in your own spending?

Yes, most definitely	☐
Yes, somewhat	☐
Yes, a little.	☐
Not to the extent I would like	☐
Not at all	☐
Not applicable	☐

5. Do you think the company could still do more to save energy?

Yes. A lot more	☐
Yes. There are some things we can change	☐
I think we are doing fine	☐
I don't see my opinion as important.	☐
Indifferent	☐

6. Have you changed your practice energy saving methods at work?

For example:

Do you turn off the lights upon leaving if you are the last one in the office?
Do you turn off the lights in the bathroom upon leaving?
Do you turn off your computer and the screen at lunchtime and at the end of the day?
If you have a space heater do you only use it when necessary?
Do you opt for opening a window instead of using air conditioning?
In the break room, do you unplug microwave when finished using it?

Yes. As much as I can	☐
Yes. When I remember	☐
On an occasion	☐
No. It´s not my priority.	☐
No. Honestly it just doesn't occur to me.	☐

7. Have you changed your practice energy saving methods at home

Yes. As much as I can	☐
Yes. When I remember	☐
On an occasion	☐
No. It´s not my priority.	☐
No. Honestly it just doesn't occur to me.	☐

8. If you are not currently active, would you like to get involved in the company´s energy savings programme?

I´d take an active roll	☐
I´d help out if I can	☐
I´ll do what is asked but I cannot do much else	☐
I have enough to do, thank you.	☐
Indifferent	☐

The opinions of the employees are an important to ensure the programme advances. Please tell us your opinion on the current energy programme and what we can do to improve.

Thank you for your time to care about our company

ANNEX 3: Building Information and Historical Energy Consumption

Building Information and Historical Energy Consumption

Name of building:

Type of premises:

Address:

Gross Floor Area of Building in m^2

Year built

Approximate number of occupants

Hours of operation:

Monday-Friday

Saturday

Sunday

Annual total of hours

Records of Energy Bills:

Electricity consumption (kWh)

Average cost per kWh: _____

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Oct	Nov	Dec	Annual total

Gas (Unit)

Average cost per unit_____

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Oct	Nov	Dec	Annual total

Fuel (specify type and unit)

Average cost per unit_____

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Oct	Nov	Dec	Annual total

ANNEX 4: Survey of energy use

End use	Units/ number	Does it have a system for energy savings	Observations
Elevators			
Laptops			
Desktops with monitor			
Servers			
Small printers			
Multifunction printers			
Plotters			
Fax			
Scanner			
Photo copier			
Ceiling fans			
Split air-conditioner			
Electric heater			
Natural gas heater			
Centralised HVAC			
LED			
Halogen			
Compact fluorescent			
Candescent			
LCD TV			
Plasma TV			
Projector			
Standard TV			
Portable Stereo			
Integrated Stereo			
Coffee machine			

Dish washer			
Electric Kettle			
Microwave			
Toaster			
Sandwich press			
Coffee urn			
Boiling water unit			
Refrigerator small			
Refrigerator medium			
Refrigerator large			
Gas hot water heater			
Electric hot water heater			
Solar hot water heater			
Pumps			
Other equipment			

ANNEX 5: Company [name] Energy Plan

Company [name] Energy Plan

EXECUTIVE SUMMARY:

The objective is to summarise briefly the plan to be carried out.

It can include the following points:

1. Reasons for the energy project and what is to be gained
2. Current situation.
3. Energy plan targets and objectives.
4. Time frame to execute targets and objectives.
5. Expected participation and the energy team.

ENERGY PLAN INFORMATION:

1. Date of report
2. Author/s
3. Acknowledgement of key staff involvement
4. Building name and location

BACKGROUND:

Describe the current situation.

Some points that can be included:

1. Common practices used (monitoring, metering systems, programmes for energy conservation)
2. Office equipment, appliances, luminaries etc used.
3. Past successful projects.
4. Include past feasibility studies and reporting.
5. List challenges and limits to achieving energy efficiency goals.

ENERGY POLICY AND BEST PRACTICES

State the company´s energy policy here. This can be copied from the statement used to communicate the company´s commitment (**ANNEX 1**).

ENERGY TEAM

Here is where all managers and participants will be identified along with position and role they fill.

NAME	POSITION	ROLE

ENERGY BASELINE

There are several ways of expressing the energy baseline. It can be shown with broad strokes or can be very detailed. The auditor or ESCO should have information regarding the baseline established from the audit that he or she can provide.

One example is presenting the data by fuel type.

ENERGY, FUEL, RESOURCE	TOTAL ANNUAL CONSUMPTION	TOTAL ANNUAL COST
Electricity		
Natural gas		
Fuel oil		
Biomass		

This data can also be presented in percentages in a pie chart and annual cost in a line graph.

Another way of showing data is by breaking it down by end use types. Here is a list of examples of areas of end use. However, the list does not have to be so detailed.

End use	Units/number	Number of hours/week	Characteristics
Laptops			
Desktops with monitor			
Servers			
Small printers			
Multifunction printers			
Plotters			
Fax			
Scanner			
Photo copier			
Ceiling fans			
Split air-conditioner			
Electric heater			
Natural gas heater			
Centralised HVAC			
LED			
Halogen			
Compact fluorescent			
Candescent			
LCD TV			
Plasma TV			
Projector			
Standard TV			
Portable Stereo			

Integrated Stereo
Coffee machine
Dish washer
Electric Kettle
Microwave
Toaster
Sandwich press
Coffee urn
Boiling water unit
Refrigerator small
Refrigerator medium
Refrigerator large
Gas hot water heater
Electric hot water heater
Solar hot water heater

SAVINGS PROJECTS

System	Annual consumption	Savings measure	Estimated savings	Source of information	Date of information
Laptops				ESCO, internal study, etc	

EMPLOYEE AWARENESS PLAN

"If you think education is expensive, try ignorance"

-Derek Bok

This should include the measures, timelines and participants that will take part in the awareness plan.

Target everyday actions that employees will be encouraged to do and how they will be communicated and by who.

ACTION (Workshop, pamphlet, etc.)	RESPONSIBLE	TIME FRAME

ENERGY CONSERVATION TARGETS

YEAR	LOW TARGET (MWh)	HIGH TARGET (MWh)
1		
2		
3		
4		
5		

ACTION PLAN

Turn targets into tasks with timelines and indications of who is responsible to carry out the task.

Identify challenges to implement the action and solutions.

For each task identify approaches and strategies: Behavioural, organisational, maintenance, other.

Description	Energy type	Project stage	Energy Savings	Cost	Responsible person	% completed	Completion date	Observations

These tasks should be tracked to monitor their progress:

Commit to having meetings of the team on a regular basis to talk about the progress of the plan and the problems encountered.

The following table can be used to identify economics, benefits and risks for each task.

Conservation Measure	Feasibility Study Complete (Y/N)	Estimated Energy Savings (MWh)	Estimated operating peak MW reduction	Estimated cost	Available incentives	Project payback	Productivity, quality, or yield savings	Ease of implementation (easy, medium, hard)	Risk

IMPLEMENT BUDGET

This budget should include costs of the energy manager, running the management team, projects, employee awareness, etc.

(Source: OPA energy Management Template)

ANNEX 6: Buyers guide for energy efficient technology

A BUYERS GUIDE FOR ENERGY EFFICIENT TECHNOLOGY

The starting point for purchasing energy efficient products and services is to have a purchasing policy that takes into account the energy implications of your purchasing decisions. All purchasing decisions should start with a needs evaluation so that you only buy what you really need. Resultant specifications should include energy criteria and the whole life costs of the items.

Some basic tips for purchasing energy efficient equipment include (*see 4.1.3: Investigating our options*):

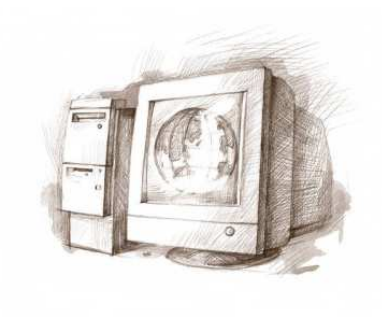
- ✓ Look for the Energy Star Label.
- ✓ Compare energy labels
- ✓ Get the right size
- ✓ Use natural gas
- ✓ Think long term
- ✓ Consider the product´s travel distance
- ✓ Could you have bought it locally?

In this annex we address specific tips for choosing the right office, lighting, HVAC and kitchen equipment.

OFFICE EQUIPMENT

Office equipment and small power machines (PCs, monitors, fax machines, photocopiers, printers, fans, kettles, coffee-makers, vending machines etc.) typically accounts for around 15% of total office energy consumption. Office equipment also generates heat which must be removed in hot weather, often by expensive air conditioning or cooling.

COMPUTERS AND MONITORS



- **Consider upgrading existing equipment**. Most computers can simply be upgraded with newer, more energy efficient components. Look into this before purchasing new equipment.

- **Explore modern alternatives**. Upgrade to flat screen (LCD) monitors to reduce monitor energy use by over two-thirds (old monitors use up to 85W). These screens emit less radiation than standard monitors and there are also obvious space advantages.

- **Consider using laptops**. They have been developed to be as energy efficient as possible, because of their usage patterns. Using laptops and docking ports can maintain familiar desktop arrangements of mouse, keyboard and monitor combinations and increase workspace flexibility.

- **Match the computer to the task**. Bear in mind current and predicted business requirements and purchase equipment that meets these. High spec PCs with large screens and fast processors use more energy. Remember, different staff roles will have different requirements, so specify accordingly Take running costs into account. Always compare equipment running and standby costs and insist that products have an energy label

PRINTERS

Energy consumed by printers varies widely but in general, the faster the print speed and the higher the print quality, the greater energy consumption.

- **Purchase for your requirements**. As laser printers are often the highest energy users both in active and standby modes, consider a high specification inkjet printer. Although they are slower, inkjet printers use less energy in standby and print modes and the print quality is usually just as good. Some businesses use lower-specification printers, like inkjets, for internal documents. Those labeled 'low energy printers' on the network can encourage staff to select these for day-to-day use. This could be made company policy or set as the default.

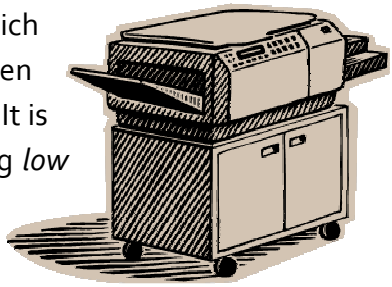
- **Look for lower operating consumption**. For regular printing, purchase a machine with the lowest operating consumption as it is unlikely to be idle for long enough to go into standby. Select a printer with the lowest standby consumption for occasional printing and where usage fluctuates; consider a machine with multiple standby steps so it can enter a higher level of standby between uses.

- **Consider printer functions.** When buying new equipment ensure printers have options for duplex printing, reducing print quality and using lower melting point inks.

PHOTOCOPIERS

Copiers use between 40-70 Watts during standby and 1,400-1,600 Watts when operating. High volume of copiers use more energy so should be used sparingly.

- **Buy lower melting point inks.** The majority of electricity consumed by photocopiers is used to heat components which fuse the toner to the paper and these are often kept hot whilst the machine is in standby mode. It is possible to reduce energy consumption by using *low melting point inks* so equipment can be held at a lower temperature. These should be available from your stationary supplier.



- **Purchase for your requirements**. Choose equipment that caters for current business needs and predicted requirements only. Consider: How fast the machine can return from standby to copy modes. The faster this is, the more energy used but the less likely it will be by-passed by impatient staff. Newer machines tend to have faster start up times. More energy is used when the faster a machine copies. It pays to have the ability to resize and copy at different print qualities. The machine should also have the ability to two-sided (duplex) copy and use low melting point toners.

FAX MACHINES

- **Consider inkjet fax machines.** Machines that use laser printing have the highest print resolution but use the most energy. Machines that use thermal paper are the least expensive to buy but the paper is expensive, has a short shelf life and is difficult to write on. Inkjet faxes might prove the best solution as they can print at relatively high resolution on plain paper and use less energy than their laser printing equivalents.

- **Use combined machines.** In smaller offices or where workloads allow, it may be appropriate to purchase a combined machine that operates as a printer, fax and photocopier. Having only one machine switched on will significantly reduce energy consumption and reduce the amount of heat produced. This will lead to a more comfortable working environment and it also has added space

advantages. When considering such machines, consider the average power consumption and standby consumption figures for the whole machine to ensure it will be more efficient for your business needs.

AIR CONDITIONING AND FANS

CEILING AND DESK FANS

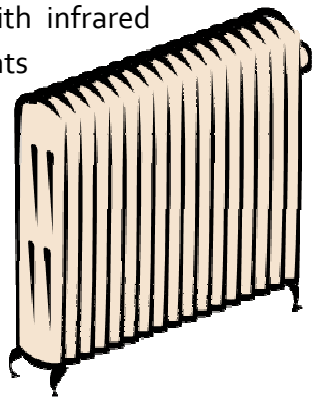
- **New fan models.** Look for new ceiling fans models they can use 35% less the energy compared to the ones manufactured 10 years ago. They also have variable speed control from 0 to the maximal speed and lower noise levels. Their lifecycle depends on how often they are being used but at maximum load they can operate no longer than 10 years.

SPLIT UNIT

- **The contemporary appliances** of that type are based on thermo pumps 'air-air', 'air-water', and 'water-water'. The good models are using DC-invertors, heat agent Freon (usually R410A, but R417A is also being used) and COP (coefficient of performance) between 3 and 4.5 depending on outer temperature. The contemporary air conditioning split units have a low level of noise and various user settings for easy control and functioning (such as 'sleep mode', 'auto', etc.).

ELECTRIC HEATER

- **The new appliances** for electric heating are divided generally into two categories: 1) convector type and/or 2) appliances with infrared heaters. They are equipped with timers and thermostats which allow for maintaining a constant temperature in premises they heat and depending on the variable conditions inside. The efficiency of these devices is very high, normally reaching and even exceeding 98%.



NATURAL GAS HEATER

- **Go for gas infrared heaters.** There are two ways of heating with natural gas – through hot water boiler which supplies heat to the heating system of user; and through gas heaters which are directly burning natural gas. The contemporary solution is the second choice – gas infrared heaters with variable design which can provide heat to a wide range of users. That efficient and environmental way of heating can be used for households,

almost all public and commercial buildings, as well as some industrial sites. The advantages of gas infrared heaters are: high efficiency and possibility for an automated process control. This way of heating allows for savings of natural gas of up to 2.5 times in comparison to the traditional gas heaters.

CENTRALISED HVAC (ELECTRIC AND NATURAL GAS)

- **Centralised HVAC systems.** The contemporary systems which use electricity and natural gas are being installed in large public and commercial buildings. They are also used in some industrial sectors. Their usage in household sector is limited due to their high prices and large number of components. The energy efficient systems of that kind are providing an energy recuperation of exhaust air, automated control of the energy source which is being used (natural gas and electricity) depending on the variable environmental parameters – temperature, solar radiation, wind, etc. These systems must be connected to and controlled by a building energy management system (BMS).

CENTRALISED HVAC (ELECTRIC ONLY)

- The **contemporary centralised HVAC systems** which use only electricity are also being installed in large public and commercial buildings. Chillers (for cooling) are being used in large buildings, as well as thermo-pumps 'air-air' (for heating) and ventilation systems for recuperation of energy of the exhaust air. In households more appropriate are thermo-pumps 'air-air' and 'air-water'. The contemporary thermo-pumps of that kind are having DC-invertors and their COP is between 2.5 and 4.5.

CENTRALISED HVAC (BIOMASS)

- **Modern Biomass HVAC systems.** These systems which are using only biomass as an energy source are generally split into two categories: 1) systems which are using pellets with thermal capacity up to 30 kW, and 2) systems which are using wood chips for larger capacities. The contemporary HVAC biomass systems are having a high efficiency (more than 90%) and operate completely automatically. Their controllers can be easily connected to a BMS. The cleaning of container from residual ash is performed once in a week.

LIGHTING

The highest energy consumption in all types of buildings is spent in lighting. However these percentages can vary greatly. Usually a simple office can consume between 30 and 70 % of the energy in lighting. The use can depend of many factors such as the climate zone, type of building construction, etc. Industries, on the other hand can consume about 10 to 30 % of their total energy on lighting since machinery can also have a high consumption.

INCANDESCENT BULBS

- **Out of date.** Incandescent bulbs refer to the traditional bulbs we have used for years. However these bulbs are now obsolete.
- **Replace with LED.** It is easily demonstrated that a similar bulb with LED technology is the best option. They save energy and money and emit less heat.
- **Prohibited.** Incandescent bulbs are currently prohibited be sold to consumers.

COMPACT FLUORESCENT BULBS

- **Mercury content**. These lights are a second runner up to the LED bulb but are not the best option since they contain mercury. Mercury is both hazardous to the environment and human health.
- **Get with the programme.** Ten years ago these were the best technology but now in comparison with LED technology is obsolete.

DOWNLIGHTS

These lights and light tubes are the most typical for illuminating in buildings downlights have three different types of technologies: Low consumption bulbs, halide metal and LED.

- **Duration of use.** Consideration for the time needed to light an area should be made before choosing downlight types. For low use areas, sometimes halide and low consumption bulbs can prove more economical.
- **Economic study.** An economic study should be done to determine the best type of lighting.
- **LED option**. LED lights are the most energy efficient however in this case may not be the most economic in low use areas.

LIGHT TUBES

The two most common types of tube lighting are: T8 fluorescent tubes and T5 fluorescent tubes. There are slight differences between these types. T5 is slightly smaller than the T8. The T5 has a slightly higher efficiency and higher lumen than the T8. However, this does not always equate that the T5 is necessarily better. T5 tubes also require a different installation than the T8, making changing one type to another difficult.

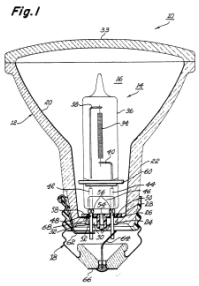
- **Getting help pays off.** It is best to consult a professional to carry out an economic study to help decide which lighting option is the most affective and help with its installation.

BELLS

Bells are very popular in industries, stores, and public buildings like gyms, libraries, pools, sport centres, etc. In this case, the main options are halide metal, High Pressure Sodium Vapour, Low Pressure Sodium Vapor, mercury vapor and obviously LED.

- **Do not choose.** The worst option in terms of efficiency is the mercury vapor for hallways.
- **Make the switch to LED for common areas.** These must be change to LED and will have good results.
- **Carry out a study.** To determine the best option have a study done.

DICHROICS



Normally dichroics are used in a variety of applications. They can be used for shelves, banners, desktops and large rooms. They are good for focused lighting. Historically these bulbs were halogen: GU5.3 with 12 Volts and GU10 with 220-230 Volts. However these lights are now available with LED technology.

- **230V.** We recommend the 230V because they do not need a transformer. Using transformers can result in loss of energy.
- **Change to LED Dichroic**. It is recommended to change to LED dichrioc and an economic study is not needed since the savings difference is always high.

PROJECTORS AND OTHERS

- **The newer models have LED technology.** These are good options for office use but perhaps for larger projectors (for theaters and such) LED may not have the power needed (just yet).

VISUAL

Offices and homes use numerous types of screens, TVs, PCs, laptops, tablets, etc. we are bombarded with advertisements telling us that their brand has the best technologies and we are made to think that newer is better.

- **Lease to most efficient**: Plasma, CRT, LCD and LED. Logically the most efficient are the most costly.
- **LED screens are the most efficient**.

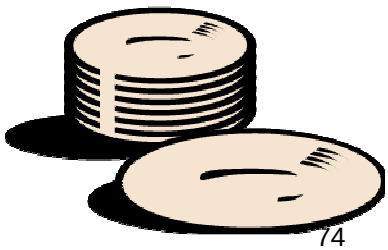
KITCHEN

There are some basic tips when purchasing kitchen appliances:

- **Buy the right size.** An appliance that is too big for your needs will only end up wasting energy.
- **Look for Energy Star** or other energy certification
- **Compare Energy Guide Labels.** Helps to determine the energy it needs to operate the appliance. It also help to carry out a comparison. Compare labels for products that have the similar characteristics (sized and capacity, ect)
- **Electricity grid capacity.** Pay attention to the electricity capacity of your facility based on the approved project design and calculate the new electrical capacity of buying kitchen appliances.
- **Fire risk assessment.** Take into consideration the fire risk of the buying kitchen appliances in function of the condition of your home electricity grid, the place of installation and storage and the location of the near combustible objects.

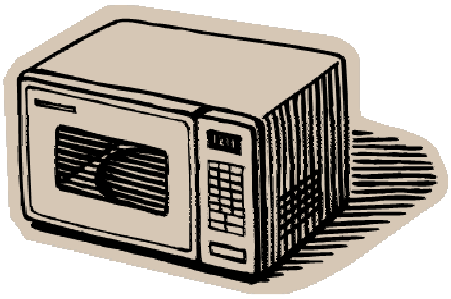
DISHWASHERS

Dishwashers before 1994 can use much more water than the most recent models. Changing out older models for newer ones can give good results.



- **As always**. Look for Energy Star, compare energy labels for like-products and buy the size right for your needs.
- Select a dishwasher rated the best in class for energy efficiency, spin efficiency and wash performance.
- **Choose the right size.** Establish your actual use before purchasing then match the model to your use.
- **Choose a dishwasher with several wash cycle options**. Having a choice of cycles can save you energy. The slightly soiled dishes can sometimes just need a short cycle to get cleaned.
- **Go ECO.** Look for machines with an ECO button that can also help reduce energy and water use.
- **Technology to look for**. Look for appliances that offer:
    - Soil sensors detect cleaning level
    - Water filtration allows efficient use of detergent to better remove food residuals
    - Efficient jets use less energy need to distribute detergent
    - Adjustable racks (to take better advantage of space)

MICROWAVES, OVENS AND STOVES



Microwaves use up to 80% less energy than a conventional oven. If in a warm climate or during summer months, microwaves also can save on air conditioning since they do not produce heat like an oven.

- **There is no Energy Star rating for domestic microwaves, ovens or stoves.**
- **For commercial ovens look for the Energy Star Label**
- **Look for the Energy Guide label.** The label will help to compare similar models and estimate the annual operating costs.
- **Choose the right size.** Estimate the use and volume you will need before buying.
- **Choose gas ovens over convection.** Gas ovens cost more up front but operating costs and energy use will be lower.

BLENDERS, TOASTER, GRILLES

There are many models so pick one that suites best your needs and follow these points:

- **Choose a blender, toaster and grill with easy cleaning**. The easy cleaning of the kitchen appliance will lead to reduction of energy and operational cost.
- **Go ECO**. Look for appliances with an ECO label and this will also help you to reduce energy.
- **Choose the right model.** Compare the technical parameters, capacity and functions of the appliances before buying.

REFRIGERATORS

The refrigerators are switched 24 hours per day, weekly – 7 days, so it is well worth finding models that are energy efficiency. Taking the right decision depends on the best cost/quality ratio and ecology you will save money and reduce kilograms of carbon dioxide over the lifetime of the refrigerator.

- **New refrigerators** consume 75 % less energy than those produced in the late 1970s.
- **Compare energy guide labels**. Refrigerators must have all an A+, A++ or A+++ energy rating (class). However because the energy rating is based upon classification by size, a smaller A rated fridge could use less energy than a larger A rated fridge. You can compare the total annual energy consumption of appliance in kWh/yr. by looking for their installed capacity in kW displayed on the energy label.
- **Get the right size**. Refrigerators with freezers on top use 10 to 25 % less energy than a side-by-side model of equivalent size.
- **Multiple refrigerators.** A larger refrigerator usually needs more energy to run. However, two small refrigerators use more energy than one larger one.
- **Skip the ice maker.** Not only are they more expensive they can use 14-20% more energy.

HOT WATER

Gas

There are two ways for hot water preparation with natural gas:

The first way is through heating boilers, i.e. the preparation of hot water is combined with heating the premises. The major problem in that case is the **inefficient operation of boilers during summer season** when only hot water is required (operation out of the heating season). When boilers have large capacities, their usage during such season is even impossible because that kind of boilers have limitation on minimal load.

- **Buy individual gas-fueled boilers.** The second and more efficient way is through individual gas-fueled boilers. This way of hot water preparation is much better in terms of energy efficiency and functionality. The contemporary boilers of that type are fully automated, heat-insulated with polyurethane, which allows for continuous storage of hot water without additional energy. Normally, the efficiency of those boilers is over 90%.

ELECTRIC

- The contemporary electric boilers have a full electronic process control for heating up water. They have a very good insulation which allows for storage of hot water up to 48 hours without energy consumption. Their efficiency is over 96%.

SOLAR

Solar energy is an eco friendly solution for supplying the building facility with hot water and to support the operational work of the installed boiler for heating. A lot of buildings in the EU rely on the national grid for natural gas and electricity not only is this expensive it is also contributing to the shocking effect of global warming. Solar thermal for domestic hot water (DHW) and heating is increasingly popular alternative to replacement of fossil fuels to renewable energy. On the other hand solar thermal has ability to drastically reduction of energy cost for the building's owners and green house gas emissions (GHG).

- **Choose vacuum-tube panels.** There are various designs of solar panels for hot water preparation. Vacuum-tube panels ensure high efficiency. They have very low heat losses, operate well in cloudy weather, and they can supply 100% of hot water for a household during summer season, while the rest of the year – from 40% to 85%. The heating liquid is antifreeze which allows for year-round use. These appliances are normally combined with electric boilers so that hot water preparation can be ensured during cold seasons of the year.

BIOMASS

Wood fuelled heating systems, also called biomass systems can utilized wood pellets, wood chips, wooden logs, agriculture waste and they provide heating and hot water in the individual home and large buildings. Biomass system can heat many homes via central heating steam or hot water biomass boilers in thermal power plants or CHP plants. A boiler burns logs, pellets and chips is connected to the central heating system and DHW system can significant reduce the energy costs compared to electricity, natural gas and diesel oil.

- **Individual biomass systems** for hot water preparation are being used only when large quantities of hot water are needed, for example at industrial sites. In all other situations, these boilers are combined with space heating. The contemporary systems of that kind are fully automated; they have very good insulation and efficiency above 90%.

PRODUCTION OF ENERGY:

Although not all options are a perfect fit for all locations and building needs here are some energy production systems that should be considered:

COMBINED HEAT AND POWER (CHP)

Combined Heat and Power, or CHP as it is more commonly referred to, is the simultaneous generation of usable heat and power (usually electricity) in a single process. In other words, it utilises the heat produced in electricity generation rather than releasing it wastefully into the atmosphere. CHP is sometimes referred to as co-generation or cogen.

On balance, co-generation can result in savings of up to 50 per cent of CO_2 emissions compared with conventional sources of heat and power.

Initiating a CHP evaluation is a decision that requires careful consideration. The most important thing is that there is a suitable heat load – the more constant the better. A

CHP operating for ½ the year will save ½ the energy compared to one operating all the time.

After a preliminary investigation, it is generally recommended to get advice from a specialist consultant or contractor to carry out a detailed feasibility study.

WIND POWER:

A Wind Turbine converts the kinetic energy in wind into rotary mechanical energy that is then used for the generation of electricity. In Ireland the most efficient models are added to the Triple E list where the three Es' stand for Excellence in Energy Efficiency. Each piece of equipment must satisfy certain criteria to be eligible to attain the Triple E accreditation. There are similar accreditation schemes in the UK for the microgeneration certification scheme (MCS) and for the ECA.

Purchasers of wind turbines should

- Carry out a site assessment to check if there is a good wind resource
- Check that equipment is CE marked
- Check that the wind turbine has been tested according to the appropriate European Standards and/or equivalent International Standards
- Check operating and maintenance manuals for equipment
- Carry out a financial assessment to determine the likely payback. This will vary depending on feed in tariffs, projected energy yield (from the site assessment) and the cost of the wind turbine.

Points to note

- Installations often require planning permission from the local authorities
- Buildings, structures and trees can create turbulence and severely affect the performance and output of wind turbines.
- Studies and installations should be carried out by qualified personnel

PHOTOVOLTAIC:

Photovoltaic panels are widely used internationally and as have proven to be an effective means to generate electrical energy. In Ireland the most efficient models are added to the Triple E list where the three Es' stand for Excellence in Energy Efficiency. Each piece of equipment must satisfy certain criteria to be eligible to attain the Triple E accreditation. There are similar accreditation schemes in the UK for the microgeneration certification scheme (MCS) and for the ECA.

If you're thinking about getting solar p-v you should

- Carry out a site assessment to check the solar resource and potential shading
- Check that all items of the equipment/system are CE marked
- Check that PV modules must comply with the relevant standards and have certified performance test reports
- Check operating and maintenance manuals
- Photovoltaic panels should be mounted so that they can harness winter and summer sunlight.

You should consider carefully the economics of energy generated from photovoltaic systems. In some cases they are employed to promote an environmentally-conscious image. Normally the panels are connected in to a building's utility supply at the distribution panel. At night, all power for the building is taken from the utility mains supply but during daylight hours the Photovoltaics can supply a contribution of the power requirements. Buildings with large roof areas such as hospitals, shopping centres and some industrial facilities can accommodate many panels to power their high electricity needs.

Typical payback periods will depend on the type of construction used for the modules, electricity costs and will generally be greater than 10 years. On the other hand, the savings will be dependent on the size and application of the system.

Points to note

- Installations often require planning permission from the local authorities
- The angle of the panels relative to the sun will determine the effectiveness of the system

- Studies and installations should be carried out by qualified personnel

BIOMASS:

Biomass boilers provide an efficient, automated method of generating hot water, steam and other heat-transporting fluids using carbon neutral biomass as the fuel source. The term "Biomass" can include Short Rotation Forestry, Energy Crops, Wood Wastes, Agricultural/Industrial Residues and/or Sewage. In Ireland the most efficient models are added to the Triple E list where the three Es' stand for Excellence in Energy Efficiency. Each piece of equipment must satisfy certain criteria to be eligible to attain the Triple E accreditation.

If you're thinking of buying a biomass boiler you should:

- Assess the heat load and the suitability of a biomass boiler. Biomass boilers are generally more suited to more constant heat demands.
- Evaluate fuel storage space and system requirements
- Check that all items of the equipment/system are CE marked
- Check boiler efficiency and performance as per relevant test standards
- Check operating and maintenance manuals

A financial assessment based on fuels costs, heat loads and boiler costs should be carried out to determine the life cycle costs relative to potential alternatives.

SOLAR THERMAL

Solar hot water systems convert sunlight into hot water and are designed to meet a proportion of your overall hot water requirement over the year. As the resource, sunlight, is seasonal this is this is usually 50-60% of the annual hot water requirement, but this can vary depending on economics and hot water requirements.

There are many different brands of solar thermal collectors on the market and many suppliers to choose from. There are two main types of solar collector available on the market, flat plate and evacuated tube.

If you are thinking about solar panels you should consider the following.

- Assess the heat load and the suitability of solar panels and the approximate size required. .
- Check that all items of the equipment/system are CE marked
- Check performance as per relevant test standards and certification to Solar Keymark or similar schemes.

- Check operating and maintenance manuals.

ENERGY SAVING EQUIPMENT

The following is equipment that should have special consideration and can save energy in a building over time:

INSULATION:

Insulation of walls, floors, ceilings, pipes and pieces of equipment are essential to reducing energy costs through heating. Many types can be used depending on the location and applications available. The types include Mineral/Rock/Sheep Wool, Polystyrene slabs, Cellulose fibre and Multi-Layered foil. Upon installation we must consider the space available and select a type which will give the required Thermal Resistivity from the maximum thickness available.

Techniques of installation can vary depending on whether it is a new build or a retrofit. In both cases the installation is always considered to be an investment. The payback is reflected in the drastic reduction in the use of heating equipment in a given building. As with all installations the workmanship should be to the highest standard coupled with approved and CE certified products to ensure the effectiveness of the insulation.

U-Value is the measure of the rate at which heat is lost through a material. As it is a measure of heat loss, the lower the U-Value the better. So for example, one square meter of a standard double glazed window will transmit about 2.5 watts of energy for each degree difference either side of the window (denoted by the unit W/m2K) whereas a low-emissivity window will do better at about 1.8 W/m2K. Simply put the lower the U-Value, the greater the effectiveness.

The Building Regulations require that all new buildings achieve minimum standards of energy efficiency. Levels of insulation higher than those required in the Building Regulations are in many cases worthwhile, since today's buildings can be expected to be occupied for 60 years or more, and an energy-efficient design can yield considerable savings over its lifetime.

When insulating you should consider the following and discuss with suppliers and contractors.

Wall Insulation

- What type of wall do I have? Cavity, Solid brick or concrete, metal frame, timber frame etc. This will determine what types of insulation are suitable.
- What type and what amount of insulation should you install to achieve the most cost effective solution?
- Is there a risk of condensation?
- How much and what type of insulation is needed?
- What is the u-value before and after

Roof Insulation

- What type of insulation is best – insulating at the roof or ceiling level?
- Do you need to access the roof/attic space?
- What type and what amount of insulation should you install to achieve the most cost effective solution?
- Is there a risk of condensation?
- How much and what type of insulation is needed?
- What is the u-value before and after

WINDOWS

Of all the components in a building, it is through the windows that most heat is lost. This is because glass allows heat to escape more readily than most other building materials.

For example, given the same area of wall and window, the window will allow up to eight times more heat to escape. For this reason, it is important that your windows are as efficient as possible.

While standard double glazing is a great improvement over single, even more advanced glazing systems are now available on the market at affordable prices. Two examples include gasfilled double glazing and low emissivity glazing.

In gas-filled double glazing the cavity between the two panes of glass is filled with an inert gas (usually argon) which conducts less heat than air, therefore improving the window's energy efficiency.

Replacing windows is generally expensive and is usually only worth it if the windows are draughty and single glazed. You should ensure that new windows have as low a u-value as your budget allows (good quality double glazing will give a u-value of 1-1.5).

The window should be certified to a relevant test standard or should have an energy label (eg http://www.bfrc.org/). .

ANNEX 7: Best operating practices

BEST OPERATING PRACTICES

Making sound decisions every day takes knowledge, awareness and practice. The following best operating practices can be used in awareness campaigns in your company. Use the information to create reminder stickers, posters and flyers to inform employees and building users about energy savings and in workshops and training events.

- ✓ Keep everyone informed.
- ✓ Allocated responsible

OFFICE EQUIPMENT

COMPUTERS AND MONITORS

A monitor can account for a large amount of a computer's energy consumption (85 Watts on average for older screens) and since these are often left on when users are away from their desks, there are big opportunities to make savings. Ensure monitors are turned off if users are to be away from their desk for more than ten minutes and that computers are switched off at the end of each day. Enable any standby features to limit energy consumption.

Small to medium-sized companies typically rely on employees to set their own PC profiles whereas this is often centrally controlled in larger companies. Encouraging IT departments as well as individual users to activate standby modes will result in energy savings. It is a good idea to establish a policy that not only covers energy efficiency tips but also guidelines for purchasing new equipment. As some brands of office equipment use less energy than others, it is important to consider the running costs of all options, and not just the purchase cost.

A single computer and monitor left on 24 hours a day will cost around €60 a year. Multiply that by the number of computers your business has to understand what this might be costing you. Switching them off out of hours and enabling standby features could reduce this to less than €15 a year each and prolong the lifespan of equipment.

- ✓ **Switch off equipment at the end of every day** and only switch on when required the following day. Enable printer standby modes and print in batches where possible to allow the machine to spend more time in standby than idling. Newer printers start up faster, so employees are more likely to be happy about turning them off. Install a plug-in seven-day timer to reduce the likelihood of machines being left on out of hours. These can be bought for a few pounds from most DIY stores.

- ✓ **Use the right printer for the job**. Print internal documents with no immediate time requirements on slower black and white machines. Only use colour when absolutely necessary. Encourage staff to use print preview functions for checking layout and style instead of printing. Default to meet most likely demand. Make it company policy to set default printing to double-sided (duplex). Reduce the default print quality for internal documents and draft outputs to increase print speeds and reduce toner use. Decrease print margins to minimise paper use. Raise awareness. Keep staff informed of the energy that printers use. Encourage them to question their printing habits such as printing unnecessary documents and forgetting to collect them from the printer. Staff should be made aware of the amount of paper used each month and encouraged (or incentivised) to reduce this.

Laser printers use the same technology and consume similar amounts of energy as photocopiers. You can achieve savings by:

- ✓ **Printing in batches** to reduce the time printers are idling
- ✓ **Turning the printer off** when it is not in use.
- ✓ **Ink jets use less.** A laser printer in sleep mode could use double the energy of a similar specification inkjet printer.
- ✓ **Energy efficient printers** can drop to 15-45 Watts or less in standby mode, depending on type and specification.

PHOTOCOPIERS

- ✓ **Allocate responsibility for switching off machines** to one person to ensure this is carried out at the end of each day.
- ✓ **Consider installing plug-in seven-day timers** to automatically switch off photocopiers out of office hours and reduce costs. Maximise standby savings. Always ensure standby features are enabled. Try to encourage staff to copy in batches where possible, to allow the machine to spend more time in standby than idling. Match the copier to the job.
- ✓ **Stick to black and white copiers** and only use colour when absolutely necessary. Use high volume machines for large jobs but if high volumes of small copying jobs are more common, use low volume, fast response machines with low melting point inks.
- ✓ **Set default copying to double-sided** and ask staff to think carefully about the number of copies actually required so as to save on energy, paper and waste disposal costs.

FAX MACHINES

- ✓ Because fax machines will be in standby mode for most of the day, it is a good idea to **choose a machine with the lowest standby energy use**. Some machines have a buffer which allows them to store

messages and print them all at the same time which will increase the time that the machine is in standby.

- ✓ **Operating options**. Choose a machine with a toner or ink-saving option, often called 'draft mode'. Ensure machines can scan double-sided pages.
- ✓ **Emails are cheaper** and save more energy than sending a fax. If a fax is really necessary, then consider sending it electronically. There are many software options enabling faxes to be written and sent via a PC. Ask your IT department, look on the internet or consult your PC user manual for more information.
- ✓ If faxes are rarely received outside office hours and your machine has a buffer, it may be possible to **switch it off out of hours**. If in doubt, check with the equipment supplier or manufacturer.
- ✓ If there is more than one fax machine in the office, you can **leave only one switched on and divert all calls** to that machine, especially when the office is closed.

AIR CONDITIONING AND FANS

CEILING FAN

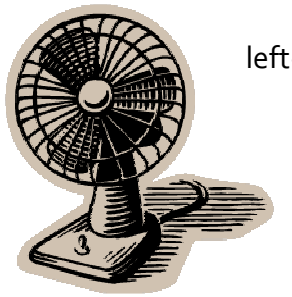
The best models of ceiling fans have possibility for variable speed control and low noise level. They do not require technical maintenance through the whole lifecycle.

- ✓ **Counter clockwise.** Ceiling fans work best by blowing air downward (counter clockwise blade rotation) in warm weather to cool the room with a direct breeze.
- ✓ **Clockwise is winter wise.** In winter, having the fan draw air upward (clockwise blade rotation) will distribute the warmer air trapped at the ceiling around the room without causing a draft.
- ✓ **Clean the fan.** For cleaning finishes, use a soft brush or lint-free cloth to prevent scratching. A vacuum cleaner brush nozzle can remove heavier dust.

Their lifecycle is between 7 and 10 years depending on the usage time.

DESK FAN

Best models have possibility for variable speed control and turn left-right. The level of noise is low.



- ✓ **Unplug from the wall socket** when left unused for a long time.
- ✓ **Place your desk fan away from heat sources** such as radiators, gas/electric fires and direct sunlight.
- ✓ Their lifecycle is **10 years** at intensive use.

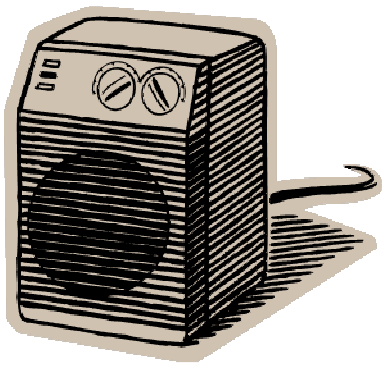
SPLIT UNIT

Split unit systems must operate without any problem when outer temperature is -15 oC or even lower.

- ✓ **Do not cool excessive indoors**. This may be harmful for your health and may consume more electricity. The recommended 24oC is suitable for human body.
- ✓ **Block sunlight with blinds** or curtains while you are operating the air-conditioner.
- ✓ **Keep doors or windows closed** tightly while you are operating the air-conditioner.
- ✓ **Adjust the direction of the airflow** vertically or horizontally to circulate indoor air.
- ✓ **Speed up the fan** to cool or warm indoor air quickly, in a short period of time.
- ✓ **Open windows regularly** for ventilation as the indoor air quality may deteriorate if the air-conditioner is used for many hours.
- ✓ **Unplug the power plug** when conditioner is not used for an extended period of time.
- ✓ Do not let the air-conditioner run for a long time when the humidity is very high or when a door or window has been left open.
- ✓ **Clean the air filter once every two weeks**. Dust and impurities collected in the air filter may block the air flow or weaken the cooling function.
- ✓ Lifecycle of such appliance is about 10 years.
- ✓ When in cooling mode, the set temperature must be maximum 21C lower than outer temperature.
- ✓ When in heating mode, split units should not be switched off (especially invertors) during the entire heating season. This is directly related to energy efficiency of the appliance.
- ✓ A technical inspection must be carried out once in a year by a professional technician.

ELECTRIC HEATER

The lifecycle of these heaters normally does not exceed 8 years. They do not have any special requirements regarding technical maintenance, but in order to take full advantage of them, one must ensure enough space for their efficient functioning, i.e. to have the so called 'good convection' and thus to avoid frequent switch-off due to overheating. Some tips when using the electric heaters:



- ✓ Set the heater's thermostat to the desired temperature.
- ✓ Do not block the hot-air outlet grilles or the intake grille located on the bottom or on the back of the heater.
- ✓ Unplug the power plug when electric heater is not used for an extended period of time.
- ✓ Never for any reason cover the appliance during operation as this could lead to dangerous overheating.

- ✓ Do not use such appliances in rooms which have an area smaller than 4m2.
- ✓ Follow safety instructions for the devise.

NATURAL GAS HEATER

The best models of that appliance are fully automated and have efficiency more than 90%. Their lifecycle is about 12 years. They require an annual technical inspection within that period, which must be carried out by a professional technician. During their exploitation one must follow strictly the safety rules which are described in a manual by the respective producer. The use of natural gas implies high risk of fire and explosion – each un-professional interference in their operation can lead to unwanted consequences!

As a room is warmed, the walls and ceilings are also warmed, making one feel a little warmer than when the ceilings and walls were cold, even though the room temperature is the same. Most of these devices have the so called 'Economy mode' which prevents discomfort from overheating and saves energy.

CENTRALISED HVAC (ELECTRIC AND NATURAL GAS)

The best systems of that kind are operating with efficiency over 92%, and have a lifecycle of more than 10 years. Their operation is fully automated. Before using them, a user must read and strictly follow manufacturer's instructions. An annual inspection is highly recommended, and it has to be performed by a professional technician.

Some tips when using these appliances:

- ✓ The space around suction and discharge holes of the system must be free of any hindrances.
- ✓ An inspection of the condition of motor and ventilation bearings must be performed at least once a year.
- ✓ It is highly recommended to install an additional gas controller which has to warn should a gas leakage occur inside the premises.
- ✓ When in cooling mode, do not allow difference between set temperature and outer temperature to be larger than 7 oC.

CENTRALISED HVAC (ELECTRIC ONLY)

The contemporary systems of that kind have three major components – a chiller (for cooling), a thermo-pump (for heating) and a ventilation system with recuperation (recovery) of energy. The overall efficiency is above 90% and the best models can almost fully recuperate energy when ventilating. Their lifecycle is over 14 years and operate fully automatically. They require an annual inspection to be carried out by a professional technician.

Some tips when using these appliances:

- ✓ If some unusual noises occur this is a signal for system failure.
- ✓ Check-up regularly the level of electric insulation of the whole system.
- ✓ Ducts must be well-isolated.
- ✓ The space around suction and discharge holes of the system must be free of any hindrances.

CENTRALISED HVAC (BIOMASS)

The best HVAC systems are operating with efficiency higher than 95%; they have a fully automated process control and in operation mode they require only cleaning of containers from residual ash which is performed approximately once each 10 days. A very important requirement for these systems is that the fuel used must meet the EU pellet standard ENplus, adopted in 2010. Specifically, the centralised HVAC systems must use pellets with quality standard ENplus A2. Using uncertified pellets might lead to damages of the system, and efficiency will decrease significantly. An annual inspection carried out by a professional technician is compulsory.

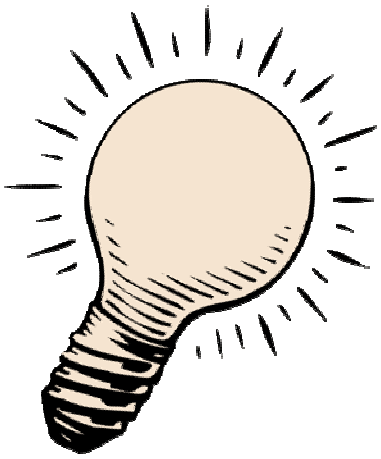
Some tips when using these appliances:

- ✓ Check the quality of the fuel, especially when using pellets. It must meet the European standard ENplus.
- ✓ Watch the flame's colour at boiler's burner. When the burning process is normal it should be orange-yellow.
- ✓ When using wood-chips as fuels, take into account that it must be dried to at least 15%. Higher humidity will lead to decrease of energy efficiency and even to malfunction.

LIGHTING

Some general lighting tips:

- ✓ Take advantage of natural light when possible.
- ✓ Install light dimmers to control light intensity
- ✓ Substitute incandescent lights and compact fluorescents for LED lights. You can save up to 80% of the energy.
- ✓ Use sensors in areas not always occupied and in hallways and stairways.
- ✓ Take advantage of natural light and use light colours to paint the walls and ceilings.



- ✓ Instruct employees on turning off electronic devices that could otherwise be left on.
- ✓ Keep lamps and screens as well as windows clean to increase lighting.
- ✓ Use LED solar lights for exterior areas.
- ✓ Advise cleaning staff to shut off lights when finished work.

INCANDESCENT, HALIDE METAL, HALOGEN AND LED

- ✓ All these technologies should be installed with sensors to minimize as much as possible starting time and reduce costs.

COMPACT FLUORESCENT BULB, LIGHT TUBE, HIGH PREASURE SODIUM VAPOR, LOW PRESSURE SODIUM VAPOR AND MERCURY VAPOR

- ✓ Sensors are not possible.
- ✓ Minimize their use or change to LED

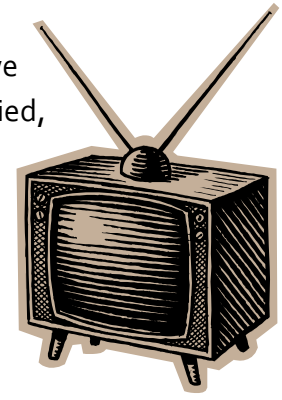
REPLACE FLUORESCENT T8 TUBES WITH LED.

It´s easy to replace T8 fluorescent tube for a T8 LED tube, all you need to do is remove the ballast and then plug the new light directly into the main current. This can prove to be the most profitable option to change.

- ✓ Depending on the duration of its use, you can see paybacks in less of two years.
- ✓ A traditional T8 of 120 cm consumes 36W, with the ballast they consume 48 W. A similar T8 LED tube of 120 cm consumes only 18W, 37.5 % less.

VISUAL

LCD, CRT, PLASMA AND LED SCREENS



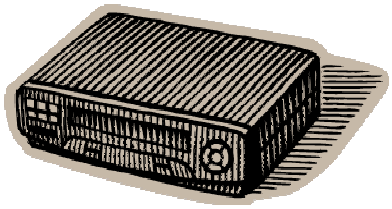
- ✓ **Don´t use the remote to turn off the TV**. Sometimes we think we are off saving the remote but as we have studied, we could save much more if we turn off directly from the plug or use power strips.
- ✓ **The truth on the standby mode.** Energy is being consumed in the standby mode. The consumption depends on the technology and can even vary even within the same technology.
- ✓ **The best option** is to switch off the entire system. It is the cheapest and most profitable in terms of energy.

- ✓ **Turn off your screen.** It is also very important not to let the screens lit a long time, it is best to turn off the computer screen when we go to have a coffee, to leave it in screen saver mode.
- ✓ **Not all screens are the same.** Some screens have different modes of brightness and display the image, if possible, should be selected eco mode that is able to reduce up to 30 % instant consumption during use.

AUDIO

PORTABLE STEREO AND INTEGRATED STEREO

- ✓ **Speakers and stereos on mute are spending energy**. You may think it´s better left on mute mode well think again. The mute mode can consume large amounts of energy.
- ✓ **Shut the stereo down completely** by switching off the power strip or unplugging.
- ✓ **Turn it down**. Raised volumes consume not just young people´s ears but also energy.



KITCHEN

Buildings that have commercial sized kitchens are the biggest energy spenders of all. Here are some general and specific energy saving tips to follow in the kitchen.

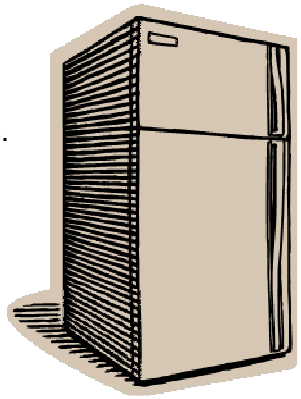
✓ Defrost items by placing them for a few hours in the refrigerator, avoiding doing it by running water over the item.
✓ Cooking equipment and pots should adequately fit the burner flame.
✓ Cover pots, casseroles and pans.
✓ Turn off heat producing appliances (electric pots, grills, etc) before finishing using them to make use of residual heat.
✓ Have a system to detect and fix water leaks quickly
✓ Plan the kitchen by creating hot and cold areas so heat is not transferred to refrigerating units.
✓ Ensure there is space behind appliances for air to circulate.

DISHWASHER

✓ **Scrape food scraps off plates,** no pre-rinsing is necessary.
✓ **Use the dishwashers only on full loads** and use economic programmes or ones with low temperatures.

✓ **Use the energy savings** cycle when possible.
✓ **Say no to heat.** Let the dishes air dry or use the no heat, air dry feature. Skipping the heat drying cycle can save energy.
✓ **Use the dishwasher.** Washing by hand uses more water than a dishwasher.
✓ **Optimise the space but make sure water circulates adequately.**

REFRIGERATORS



✓ **Hot items** should not be placed in refrigerators nor should refrigerator or freezer doors be left open without need.
✓ **Avoid ice build-up** or condensation in the refrigerator units.
✓ **Maintain an appropriate temperature.**
Maintain your refrigerator just below 4 ° C.
✓ **Position the refrigerator in a cool spot.** Keep the refrigerator away from a heat sources such ovens, dishwashers, or direct sunlight.
✓ **Allow air circulation behind the refrigerator.**
✓ Maintain a space between the wall and the refrigerator, and with older models be sure to maintain condenser coils. Always follow instructions for good maintenance detailed in the user manual.
✓ **Check the door seals.**
✓ Insure that the refrigerator closes tightly and the seal is not worn. In the case that they are damaged they can be replaced
✓ **Maintain the door closed.**
✓ Try not to open the door too often. Select what is needed all at once and close the door.

When to say goodbye:

- × The refrigerator is over 15 years old
- × The refrigerator is over 8 years old, the repairs are costly and the refrigerator is out of warrantee.

OVENS

✓ Install your oven far from your refrigerator to keep these appliances from working against each other, or add foam insulation between the two if space is limited.
✓ Resist the urge to open the oven door while cooking, as this lets valuable heat escape.
✓ Skip preheating and shut the oven off 15 minutes prior to finishing time.
✓ Keep your oven clean. A dirty oven can keep heat from transferring properly to the oven.
✓ Don't self-clean the oven more than once a month.

HOT WATER

GAS

The best gas boilers for hot water have efficiency over 90%. Their lifecycle is about 10 years. They have fully automated control and two independent security elements against gas leakage. Regardless of that, there must be a gas sensor installed so that in case of gas leakage it will automatically stop the feeding of fuel to the burner and performs an audio alert. Maintenance of such appliances is very low, but it is highly recommended to perform one technical inspection yearly. In some EU member states the annual technical inspection is compulsory.

Tips:

- ✓ A gas controller must be compulsory installed in order to watch for gas leakage inside premises.
- ✓ At least once in a month you should inspect the condition of gas connections to the unit.
- ✓ The unit must be installed away from heating appliances.
- ✓ When installing the unit, take into account it should not be exposed to direct sunlight.
- ✓ It should be installed in premises with natural or mechanical ventilation.

ELECTRIC

The good electric appliances for hot water preparation have efficiency over 98%. They have fully automated process control, cathode protection against lime scale, and a very good heat insulation which allows for storage of hot water up to 48 hours without additional energy consumption. A device which has to protect user against electric shock is installed compulsory. Their lifecycle is at least 15 years, and they do not require maintenance within that period.

Tips:

- ✓ Install RCD (fault current protection) device on the power lines.
- ✓ Check regularly the condition of the protection against excessive high pressure of water inside the unit.
- ✓ Check regularly the condition of all electrical connections.
- ✓ Check regularly the condition of connections between the unit and the water mains.
- ✓ Unplug the power plug when appliance is not used for an extended period of time.

SOLAR

The contemporary solar panels for hot water preparation are vacuum-tube with glass-resistant surface layer. This technology ensures very low heat losses and the highest possible ratio of transformation of solar radiation into heat energy. The heating fluid must be antifreeze. The

process control is automated. They require periodical dust cleaning of the panels' glass surface. Their lifecycle is 15 years, and manufacturer's instructions must be strictly followed.

Tips:

- ✓ Check regularly and if necessary clean the surface of solar panels.
- ✓ Use only antifreeze liquid as an energy-transforming agent.
- ✓ Check regularly the condition of all pipes, which connect the panel with other components.

BIOMASS

Contemporary appliances of that kind are usually using pellets which must meet the European quality standard ENplus A1. They are fully automated and have efficiency over 90%. Their routine maintenance requires cleaning of containers by wood ash once in 10-14 days. If manufacturer's instructions are strictly followed, no specific maintenance is required in addition.

Their lifecycle is 10 years.

Tips:

- ✓ Always use pellets with quality which meets the standard ENplus. If wood chips or firewood are used, they must be dried.
- ✓ The storage of solid biofuel is compulsory i.e they need be situated in dry and ventilated premises.
- ✓ All installation works, commissioning test and start up of the biomass systems must be implemented by authorized technical organization or technicians.
- ✓ The unit must be installed in a premise with air circulation – a normal combustion process requires air supply.
- ✓ Check the chimney draft. Some of the biomass boilers are not equipped by the exhausted fan.
- ✓ Take notes of the fuel consumption when maintaining the desired temperature of water. Te excessive fuel consumption means abnormal combustion process. In that case, you could contact an authorized technician.
- ✓ Regularly clean the containers from residual ash.
- ✓ The biomass boilers have to be serviced by professionals or installers. Annual maintenance of the equipment is recommended.

PRODUCTION OF ENERGY:

Energy producing equipment includes CHP, solar p-v, wind turbines, solar thermal and biomass boilers.

- ✓ This equipment is expensive and needs to be properly maintained to ensure maximum efficiency and lifetime.
- ✓ The maintenance generally needs to be carried out by a specialist contractor.
- ✓ You should check the manual and talk to your supplier and installer to ensure that the required maintenance is carried out.
- ✓ It's probably a good idea to enter a maintenance contract with your supplier or installer.

ANNEX 9: Energy Management Tools

Energy management checklist

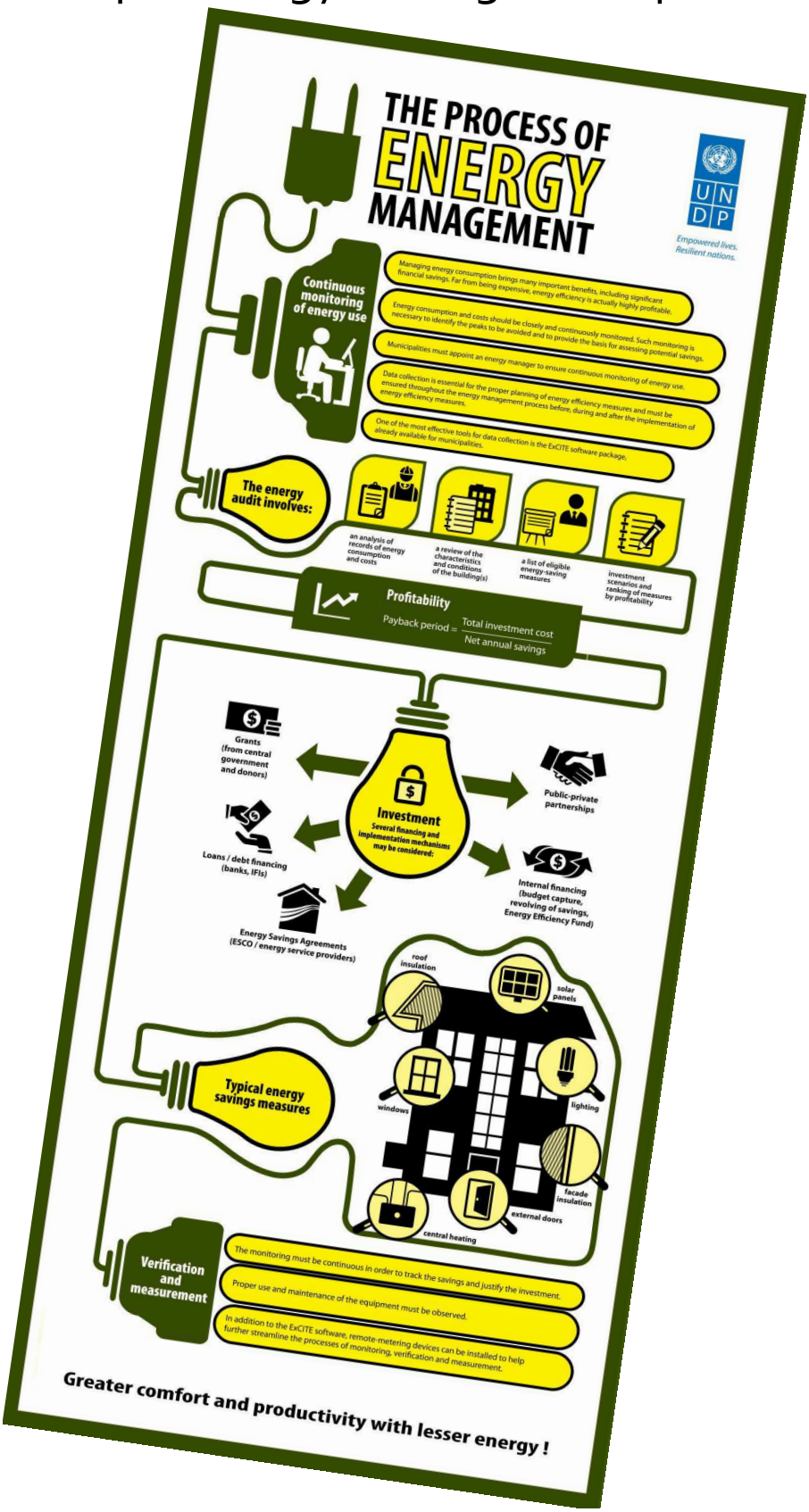
√	Action Checklist	Tips provided by the SEAI Public Sector ICT working group
☐	Senior management is committed to ICT energy efficiency	. … for resource allocation and policy change.
☐	An ICT Energy Co-ordinator has been appointed.	… with the necessary time and resources.
☐	Sufficient resources are allocated to energy management within the ICT team.	A set time per week should be allocated to this work.
☐	An ICT Energy Management Team has been established.	A small team of enthusiastic volunteers.
	Desktop	
☐	The PCs left on overnight are visible / reported.	Use central policy and controls or write scripts to report which PCs are left on after a set time.
☐	PCs are not left on after hours for updates.	If PCs are left on after hours for updates, then consider rescheduling to during the working day.
☐	Software updates are carried out during business hours only.	This may be challenging, but can be both feasible and successful with adequate

		communication to staff beforehand.
☐	All non-essential equipment is switched off out of business hours.	Can save up to 60% of office equipment energy costs.
☐	There is automated shutdown after hours.	Write script to hibernate unattended PCs.
☐	Power management is configured (stand-by is enabled).	Can save up to 30% of PC and monitor energy use during the working day.
	Ancillaries	
☐	Train key staff to operate energy equipment effectively.	After maintenance, are power settings reset and/or checked to be correct?
☐	Meter standard/model PCs to estimate total power usage.	Use an inexpensive plug-in meter to monitor over time.
☐	Conduct regular walk-arounds to check for energy waste in ICT.	Walk-arounds should be regularly scheduled as people often fall back into bad habits. Timely action will maximise savings.
☐	Turn off equipment when not required, especially in summer as it reduces heat build-up.	This improves comfort and reduces electricity use.
☐	Fit seven-day time controls to equipment that is shared.	Up to 50% saving in energy use is associated with printers and copiers.
☐	Set defaults on printers to duplex mode.	Save on energy, toner and paper costs
	Purchasing	
☐	Choose appropriate computer screens.	Replace CRT-type screens with LCD or other energy-efficient technologies.

☐	Choose equipment appropriate for the task.	Inkjet printers in sleep mode use 50% less energy than a laser printer.
☐	Purchase equipment with low energy options that match your requirements.	This could save around 10% of your printing costs alone.
☐	Have power management configured before delivery.	Make sure that it is the default setting.
☐	Purchase laptops or terminals instead of desktops: Laptop/Thin Client : PC ratio	Terminals and laptops use 20% of the power of a desktop PC.
☐	Renew ICT hardware whenever possible.	Newer equipment is increasingly more efficient than old.

Source: Guide to ICT-Desktop Energy Management. Sustainable Energy Authority of Ireland

Sample energy management poster


THE PROCESS OF
ENERGY
MANAGEMENT
UNDP
Empowered lives.
Resilient nations.
Continuous monitoring of energy use
Managing energy consumption brings many important benefits, including significant financial savings. Far from being expensive, energy efficiency is actually highly profitable.
Energy consumption and costs should be closely and continuously monitored. Such monitoring is necessary to identify the peaks to be avoided and to provide the basis for assessing potential savings.
Municipalities must appoint an energy manager to ensure continuous monitoring of energy use.
Data collection is essential for the proper planning of energy efficiency measures and must be ensured throughout the energy management process before, during and after the implementation of energy efficiency measures.
One of the most effective tools for data collection is the ExCITE software package, already available for municipalities.
The energy audit involves:
an analysis of records of energy consumption and costs
a review of the characteristics and conditions of the building(s)
a list of eligible energy-saving measures
investment scenarios and ranking of measures by profitability
Profitability
Payback period = Total investment cost / Net annual savings
Investment
Several financing and implementation mechanisms may be considered:
Grants (from central government and donors)
Loans / debt financing (banks, IFIs)
Energy Savings Agreements (ESCO / energy service providers)
Public-private partnerships
Internal financing (budget capture, revolving of savings, Energy Efficiency Fund)
Typical energy savings measures
roof insulation
solar panels
windows
lighting
facade insulation
external doors
central heating
Verification and measurement
The monitoring must be continuous in order to track the savings and justify the investment.
Proper use and maintenance of the equipment must be observed.
In addition to the ExCITE software, remote-metering devices can be installed to help further streamline the processes of monitoring, verification and measurement.
Greater comfort and productivity with lesser energy !

Tip Sheet: How to choose an installer

Advice: A university professor, an environmental lawyer whose specialty was in environmental home inspections, once told me you do not get what you deserve but rather what you bargain for. I have taken that lesson to heart. You cannot go into a negotiation blind and think you will come out on top. You must do your homework. Here is a tip sheet to help you begin.

New, more efficient and renewable energy systems can save us money in the long run however their installation can often be costly. Also if it is not installed correctly, the equipment will not be as effective or could have a shorter life. So don´t go with the cheapest installer, go with the best. It is worth the investment.

Here are some tips of how to choose an installer. Your being an informed customer will help create and push for a better market of good installers who take pride in their work.

You are **not obligated to sign on the same day** even if the installer insists you will lose an important discount. These are high pressure selling techniques that should spring an alarm that perhaps this installer is not the most reliable.

Getting started:

1. Find installers close by.

Websites for your country

Ireland:

www.seai.ie

http://www.seai.ie/Renewables/Renewable_Installers_Register/

https://hes.seai.ie/GrantProcess/ContractorSearch.aspx

Spain:

www.agenciaandaluzadelaenergia.es/empresas/subvenciones/empresas-autorizadas

Bulgaria:

www.nisbg.org/about-en.aspx

Training courses for installers of small-scale renewable energy systems in buildings

http://www.resinstaller.eu/bg

http://www.spge-bg.com/index2.php?lang=en&mainB=3&subB=1&file=en/projects/Instalers_Engl.php

2. **Compile a list.**
3. **Get at least three estimates. However, remember that just because it is cheaper does not mean you are getting the best deal.**
4. **Run through the following questionnaire/checklist to compare your selected candidates:**

QUESTION	INSTALLERS			COMMENTS
	1_____	2_____	3_____	
COST BREAKDOWN				
How the size of the equipment was calculated for your needs.				
Explains clearly necessary information and operating instructions.				
Explains in full all calculations, feed-in tariffs or incentive programme benefits.				
Explains how you should maintain the system				
They have presented a clear estimate of how much the system will save or produce (energy, heat) as well as your current requirements.				
They have indicated what will be needed and who will prove it for installation and maintenance.				
CREDENTIALS AND EXPERIENCE:				
How long has the installer been in business and installing these systems?				
Are they a member of an organization, are they certified? In				

some countries they need to be certified for feed in tariffs or incentive to apply.	
INFORMATION:	
Do they provide manuals and brochures, background and test data?	
Is the sales person knowledgeable about the product?	
Did the sales person give you information about the warranty card and after warranty service period of the installed product?	
AFTER INSTALLATION:	
What services are offered	
Warranties: All installers should provide a minimum one-year warranty on the installation	
What type of professional devices like gas analyzer, electronic tester, data loggers, etc. the installers are used.	
ESTIMATES AND QUOTES	
The company has provided the quote in writing and on official company headed paper.	
Is the system eligible of an incentive programme of Feed in Tariffs	
Explain different payment options	
What is included in the price? This should include: -Safe removal and disposal of older equipment -Drilling of trenching. -Electrical work -Connection old to new systems	
If connecting to the grid: Is a meter included or will you need to get	

one?	
In situations of heating, is the cost of integration with the actual system included?	
BEFORE SIGNING OR PAYING A DEPOSIT (from the Renewable Energy Consumer Code)	
Get it in writing: A quote including a standard performance estimate specific to your property and a full breakdown of what will be supplied; make sure it's all inclusive	
Their standard terms and conditions	
Read all information and understand it	
Never pay more than 25% of the contract price up front, and check it will be protected	
Remember that you have the right to cancel the contract. Make sure you do not waive this right.	
Any changes to the contract should be put in writing and added to the contract.	
If the company makes changes to the contract make sure that you have a written agreement. If you do not agree, you have the right to cancel the contract with no penalty.	
REFERENCES:	
Ask for references and check them.	

Recreation Centre Tip Sheet

POOLS

Reduce your heater or heat pump thermostat settings by 8-10° on days the pool is not being used.

According to the American Red Cross, the most healthful swimming temperature is 25.5° C. Reducing your heater or heat pump thermostat to maintain a 25.5° or lower temperature will also help conserve energy

Reduce pump speed to reduce energy use. A slower pump reduces power consumption

For good water maintenance, circulate water through a filter only once per day. Additional cycles tend to waste energy

Run your pool's filtration system during off-peak hours when electricity demand is lower.

Keep intake grates clear of debris. Clogged drains require the pump to work harder

To obtain maximum filtration and energy efficiency, clean your filter regularly

New variable drive pool pumps slash utility costs

Raising the water temperature just 1° can costs an additional 10 - 30%

Use LED or solar powered lighting

BATHROOMS

Use cold water when possible

Use water saving devices in faucets and toilets

Report and fix leaks as soon as possible

Unplug devices when not in use

Do not set the temperature above 40°C

Adjust the temperature of the radiators with thermostatic valves only when you use the bathroom.

LAUNDRY

When possible and sanitary wash with cold water

Always wash with a full load

Wash the filter often

Line-dry when possible

Purchase energy star equipment with A ratings or higher

Look for washers with high centrifuging capacity

LIGHTING

Use natural light when possible

Review each area and its lighting needs. Perhaps timers or sensors can be installed instead of having the light on continually

Maintain lights and lamps clean

Shut lights off when you are the last to leave the room. Stickers are helpful to remind others to do the same

Do not use decorative lighting on the interior or exterior of the building

Use led when possible

Use fluorescent lamps and compact fluorescent lamps with electronic ballast when replacing lamps with electromechanical ballast.

Report and fix maintenance problems immediately

HEATING AND COOLING

During winter months keep the temperature between 19 and 21° C

Review and maintain pumps and equipment

Maintain filters clean

Purchase Energy Star equipment

Use daily or weekly room thermostat to choose the appropriate temperature in the premises. This will lead to energy savings and temperature comfort.

KITCHEN

Refrigerator

- Maintain the back of the refrigerator clean and well ventilated
- Defrost the freezer before there is a 3mm thick ice layer
- Inspect the rubber seal on the refrigerator
- Do not place hot items in the refrigerator or freezer
- The refrigerator should be at 5° and the freezer at -18°C
- Try not to open the door too often and close it quickly

Cooking

- Use microwave when possible
- Avoid opening the oven when it is on and insure that it is well closed
- Use the pressure pot when possible
- Use residual heat to finish cooking. Shut off the stove and oven 5 minutes before finished time
- Cover pots and pans while cooking to take advantage of the heat
- Use convection ovens
- Use kitchen equipment, such as pots, pans, etc. with a diameter corresponding to

the diameter of the heating plate of the electric ovens.

Washing

- Rinse with cold water
- Use the dishwasher
- Use the dishwasher only when it is completely full and load according the manufacturer
- Use economy and short programmes when possible
- Choose an energy star rated washer

Hot water

- Turn off hot water systems when the centre is closed
- The temperature should be set no higher than 40° C
- Use gas to heat the water when possible
- Use heat accumulator (buffer tank) in the hydraulic heating and DHW (domestic hot water system).

Hospital and Health Centre Tip Sheet

EDUCATE PATIENTS AND VISITORS (STICKERS OR POSTERS CAN BE USED)

Turning off lights when not in use

Closing windows when the air or heat is on

Closing doors especially those that lead to the outside

Unplug and shut off devices that are not in use

Water savings measures

BATHROOMS

Use cold water when possible

Use water saving devices in faucets and toilets

Report and fix leaks as soon as possible

Unplug devices when not in use

Do not set the temperature above 40°C

LAUNDRY

When possible and sanitary wash with cold water

Always wash with a full load

Wash the filter often

Line-dry when possible

Purchase energy star equipment with A ratings or higher

Look for washers with high centrifuging capacity

LIGHTING

Use natural light when possible

Review each area and its lighting needs. Perhaps timers or sensors can be installed instead of having the light on continually

Maintain lights and lamps clean

Shut lights off when you are the last to leave the room. Stickers are helpful to remind others to do the same

Do not use decorative lighting on the interior or exterior of the building

Use led when possible

Report and fix maintenance problems immediately

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During winter months keep the temperature between 19 and 21° C

Review and maintain pumps and equipment

Maintain filters clean

Purchase Energy Star equipment

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Washing

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Hot water

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- The temperature should be set no higher than 40º C
- Use gas to heat the water when possible

Tip sheet for Building envelop and technical features

Upgrades can save up to 90% on heating so take note on this tip sheet.

Take a top down approach to look at your building´s envelope.

ATTIC:

If there is no access to the attic you may need to use infrared or remove material to see the installation.

If you have access to your attic grab some gloves, old clothes, respirator and a flashlight and check out the following points:

Points	Notes:
Condition of insulation	
Depth consistency of the insulation	
Animal damage	
Trampled matted down	
Water damage	
Bare spots on ceilings or framing material.	
Ventilation systems should lead outside not into the attic.	

WALLS:

How thick are the walls? The thickness of a wall determines its capacity to insulate the building. Measure the thickness of a doorway or window or drill a small whole and poke a wooden (not metal) bbq skewer into the whole and mark it when it hits the other side.

Figure out what and if any type of insulation is being used in the wall. Perhaps you need to replace it or add insulation that was never there in the first place. The type of insulation will depend on the type of climate your building must withstand.

As in the attic, the condition, the depth, water damage and bare spots in the insulation should be accessed. This may be very difficult since the wall is a closed area and could be best done by a professional.

BASEMENT:

There is a debate to whether insulate the walls or the ceiling of the space. Only insulating the ceiling may be slightly cheaper in the beginning but it neglects a large surface area that can ultimately affect the entire building.

Insulating the perimeter and floor of the basement not only creates a usable space but also helps further insulate the entire building. While you have the installers there, who are the bulk of the cost, spend the minimal extra money on insulating the entire space.

TYPES OF INSULATION

- Batts and blankets
- Loose-fill insulation
- Dense pack insulation
- Spray foam
- Rigid foam

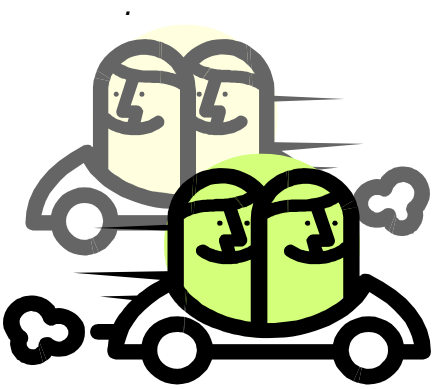
Tips:

- ✓ Do not compress the insulation, it reduces its value
- ✓ Ensure a snug fit
- ✓ Avoid gaps
- ✓ Keep it dry

Ask for guidance from a professional to choose the best insulation according to:

- Climate
- Availability
- Practicality
- Cost
- Suitability
- Building science (air, humidity)
- Global warming potential
- Ozone depletion potential
- Health risks
- Local codes
- Durability
- Fire resistance
- Sound control
- Recycled content/ recyclability
- Embodied energy

Source: *The Homeowner´s Energy Handbook.* Paul Scheckel. 2013



Travel tip sheet

A true story: A man who owned a lorry company began to suspect that one of his drivers was stealing fuel from him. He began to compare the two drivers who travelled an identical route. One was spending almost a third more of what the other had spent on fuel. Before accusing his employee falsely he carried out a careful inspection and he realised there was no double handed driver, just poor driving habits, an old lorry, and differences in vehicle maintenance. A simple course on good driving practices and tips on lorry maintenance could save him thousands per year.

Here are some ways to keep your fuel use down and save on costs:

CHOOSE YOUR VEHICLE:

- ✓ Do not select a vehicle that is larger than you really need.
- ✓ Get a vehicle with cruise control. Maintained and controlled speed can save fuel.
- ✓ Look for a vehicle with the overdrive option.
- ✓ Compare fuel economy between different vehicles.
- ✓ Consider an electric or hybrid vehicle.
- ✓ If you are 1 or 2 people and do not have baggage, consider a motor cycle or scooter.

MAINTENANCE:

Keeping your **engine properly tuned** can improve fuel efficiency by 4%. Fixing a faulty oxygen sensor can improve efficiency up to 40%.

Maintaining your **tyres inflated** to the recommended pressure can save 3.3%. A tyre can decrease its efficiency by 0.3% for each psi it is under-inflated. Properly inflated tyres are also safer and last longer. Look for the ideal tyre pressure on the sticker in the door jamb located on the driver's side and do not use the one printed on the tyre.

The use of the recommended **motor oil** can improve gas mileage by 1-2%. Check with the manufacturer's manual to know which oil best suites your engine. Look for an API performance symbol that indicates "Energy Conserving" to be sure it contains friction reducing additives.

Change **fuel filters** during the planned motor oil changing in auto service station. This maintenance will improve the efficiency and quality of your engine operation and will reduce of the periodic repairs needed.

Change dirty **air filters**. This is important for older cars. Newer cars are not affected; however a changed filter will improve driving performance.

DRIVING TIPS

- ✓ **Relax.** Rapid accelerating and braking on highways can lower efficiency by 33%.
- ✓ **Slow down.** Going slower can significantly decrease fuel efficiency.
- ✓ **Use cruise control.** The use of cruise control can cut fuel needs by maintaining a steady speed.
- ✓ **Use the overdrive gear.** If you have an overdrive gear it can be used to reduce the engines speed which will enable to save fuel and reduce engine wear.
- ✓ **Reduce mileage** by using multiple types of transport. For example, driving to a park and ride and taking the train into town or using bike shares in the city can cut gas and increase an individual's health.
- ✓ **Combine trips.** Plan your route wisely and tasks to efficiently use fuel and time.
- ✓ **Use a GPS device**. Getting lost can become not just frustrating but inefficient.
- ✓ **Turn down the air.** An air conditioner set on "max" can consumption by 5 – 25%.
- ✓ **Avoid transporting items on the rack or leaving the windows open at high speeds** since they can create drag and save 5% in mileage.
- ✓ **Get rid of extra baggage.** Extra weight can decrease fuel efficiency depending on the amount carried.
- ✓ **Avoid idling.** Keeping the engine running without moving is especially wasteful in larger vehicles.
- ✓ **Allow for time to get there.** Having enough time will allow you to slow down and drive sensibly.

- ✓ **Drive during off peak hours.** If you have flexibility plan your trip when the traffic volume is lowest.

- ✓ **Use the engine's 'sweet spot'** - the speed at which fuel economy is at its best. This is often indicated in the vehicle manual as the optimal engine performance and is expressed in rpm. If it is not available or the vehicle is not equipped with a cyclometer, attentive drivers can hear and feel when the engine is functioning with least effort.

- ✓ **Carefully park at the end of the day.** Park in a way to avoid early-morning maneuvering with cold engine - this wastes fuel because cold engines consume much more fuel than warm engines.

- ✓ **Use biodiesel.** All diesel engines can run on 100% biodiesel, though it is typically sold in lower-level blends of 2%, 5%, or 20%. In theory, adding biodiesel is cheaper however can reduce fuel economy, power, and torque since it has a lower calorific value than petrol based diesel.

ALTERNATIVES

Perhaps the cheapest, most relaxing and fastest way is by train.

Investigate other options to get from point A to B, such as:

- ✓ Public transport - conventional
- ✓ Green environmental friendly transport using hybrid, electric and bioethanol engine
- ✓ Ferry transport
- ✓ Carpooling
- ✓ Biking
- ✓ Walking
- ✓ Ride shares
- ✓ Combinations of the above

TELECOMMUTE AND FLEXIBLE HOURS.

Some companies offer telecommuting or flexible hours. Working from home can save fuel. If this is not an option a flexible work schedule can be beneficial to all. Arriving when traffic is at its lowest gives a worker more autonomy and peace of mind. These

types of employees have been proven to be the most productive and most content. Companies can benefit from offices that are staffed longer since employee times are more staggered.

TIP: Start an EPLACE account and monitor your car fuel consumption

ANNEX 10: Tools for office awareness and recognition

Ideas for Rewards and Motivation

Motivating people to change is often a daunting job but it once we get started it can be the most fun out of all energy saving tasks.

Some top tips on motivating people are:

1. **Unit people.** When people feel like they are part of something bigger they often will come together to get the job done. Make it fun and help build a team to get the task done. Offer opportunities for how employees and building users can get involved.

2. **Make it meaningful.** There is nothing more depressing than working a job that has no real meaning. So make sure you inform workers on the benefits of what they are doing and what they have achieved! The benefits are many, social, ecological and economic benefits. Here are a few items that can be posted on a bulletin board or common website
    - **What Eco-Benefits have we accomplished?**
        - How much CO_2 emissions have been reduced? Put this in terms that can be understood like number of trees or number of cars.
        - How much petroleum and carbon consumption has been reduced?
        - New collaboration efforts that name individuals.
    - **Economic-Benefits**:
        - How much money we have saved.
        - Money that has been invested in other projects/products, activating the economy.
        - Will there be a pay increase as a result of hard work.

3. **Set goals and celebrate them.** Who doesn't love to reach the top of a mountain, look down and ponder how far they have come. Once goals are reached, perhaps there is a party or just a poster of congratulations.

4. **Recognise efforts.** This is so important. If employees or building users are making a special effort, recognise it with one of the follow suggests:

- A certificate, of energy excellence
- A bonus
- A public notice
- A spot near the window, plants, extra break time
- Prizes (energy products for the home)
- Donate part of the saved money to non-governmental Environment (or human aids) agencies.

5. **Listen to suggestions.** Make workers and building users part of the process by listening to them.

6. **Keep positive.** There will be times it doesn't seem like anything is changing but positive brings positive.

Training Tools

To develop a project like EPLACE, it is necessary to incorporate and motivate the people to achieve positive results. Without proper training and sufficient information this is impossible.

Here are some training tools that can be developed to inform building users on energy savings and the EPLACE efforts being made:

- Informative eco-Posters (*see the Sample Office Poster*)
- Best practices flyers
- Use fun facts to show energy savings (*see our Myths on Energy Savings*)
- WeSave and WeLight demonstrations using the platform information and tools.
- Show how apps can calculate how much money and CO_2 have been saved using recommended best practices.
- The Dos and Don'ts in energy consumption. Make comparisons and checklists. (*see our Energy Conservation Checklist*)
- Citizen workshops that focus on how to save energy and the benefits for the environment as well as their pocket.
- Kid activities that use dissemination videos with cartoons that present Ecological/Best Practices.

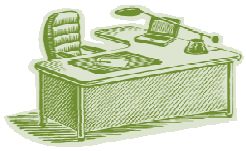
All activities should be documented showing their action, impact, results and suggestions for improvement.

General Energy Checklist

- [ ] Always use compact fluorescent lights (CFLs) in desk lamps as opposed to incandescent lights
- [ ] Switch off all unnecessary lights
- [ ] Use natural lighting when possible
- [ ] When working late, use task lighting to directly illuminate work areas
- [ ] Unplug equipment that drains energy even when not in use (is cell phone chargers, fans, coffeemakers, desktop printers, radios, etc.)
- [ ] If possible, turn off office equipment and or computer monitors at the end of the work day.
- [ ] Use efficient ENERGY STAR products.
- [ ] Close tilt window blinds to block direct sunlight to reduce cooling needs during warm months.
- [ ] Photocopy only what you need
- [ ] Always use the second side of paper, either by printing on both sides or using the blank side as scrap
- [ ] Use durable coffee mugs instead of disposable cups
- [ ] Carpool, bike, or use mass transit when commuting to work
- [ ] To save gas: drive the speed limit. Accelerate and decelerate slower, and make sure tires have the proper pressure

Source: U.S. Department of Energy

In the Office Check List



Workers

- [ ] Turn off equipment at power strip or unplug computers, screens, copy machines, printers, etc at the end of the work day.
- [ ] Turn off the monitor screen when away from the desk for more than 15 minutes (lunch, breakfast, meetings).
- [ ] Use power strips to shut off all equipment at once when not in use.
- [ ] Open windows to cool the office instead of using the air conditioning. Likewise, make sure the air is not on when the windows are open.
- [ ] Use natural lighting. Use the blinds to maximize light and minimize heat. Keep windows clean for maximum light.
- [ ] Turn off lights and other equipment when not in use.
- [ ] Do not keep chargers plugged in when not charging.
- [ ] Space heaters should be used only when necessary and turned off when not in use. Try to use appropriate clothing (sweaters, good socks) before using heaters.
- [ ] Unplug or shut off at a power strip kitchen equipment (toasters, microwaves, etc) when not in use.
- [ ] Shut off bathroom lights upon leaving.
- [ ] Use washable mugs instead of disposable dishware.
- [ ] Photocopy only when necessary and print double sided.
- [ ] Alert maintenance staff when equipment or lights are not functioning properly.
- [ ] Use energy efficiency labels to the appliances, lighting, and equipment to describe the energy performance of these products.
- [ ] At the end of the workday and before the weekend set the heating, air conditioning and ventilation systems to work in sleep mode with reduced parameters or do not work.

Maintenance and energy managers

☐	**Train and inform building users and workers on best practices and how to report problems. Locate posters and stickers throughout the building as reminders.**
☐	**Install power strips where possible so that equipment can be turned off all at once.**
☐	**Make sure computers and other equipment switch to standby after a period of nonuse**
☐	**On hot days, designate someone to open windows early in the morning to cool the building down before putting on the air.**
☐	**When the heat or air is, a designated staff member should perform walk through to ensure windows and doors are closed.**
☐	**Install blinds that maximize light and minimize heat. Keep windows clean for maximum light.**
☐	**Have a designated staff member turn off lights at the end of the day.**
☐	**Change bulbs to LED.**
☐	**Do a weekly check on all equipment to make sure it is properly working and have a plan to fix the equipment immediately if it is not.**
☐	**Respond to worker notification quickly if something is not working properly.**
☐	**Use Energy Star equipment or equipment that has had an high efficiency energy rating.**
☐	**Make sure equipment is maintained according the manufacturer.**
☐	**Use only original spare parts when it is necessary to change or replace the damage equipment.**
☐	Keep constant reports and statements of faulty equipment. Reflected in the report the type of defect causes and timing of replacement equipment.

Source: U.S. Department of Energy

My home: Tip Sheet

BATHROOMS

- Use cold water when possible
- Use water saving devices in faucets and toilets
- Report and fix leaks as soon as possible
- Unplug devices when not in use
- Do not set the temperature above 40°C

LAUNDRY

- When possible and sanitary wash with cold water
- Always wash with a full load
- Wash the filter often
- Line-dry when possible
- Purchase energy star equipment with A ratings or higher
- Look for washers with high centrifuging capacity

LIGHTING

- Use natural light when possible
- Review each area and its lighting needs. Perhaps timers or sensors can be installed instead of having the light on continually

- Maintain lights and lamps clean
- Shut lights off when you are the last to leave the room. Stickers are helpful to remind others to do the same
- Do not use decorative lighting on the interior or exterior of the building
- Use led when possible
- Report and fix maintenance problems immediately

HEATING AND COOLING

- During winter months keep the temperature between 19 and 21° C
- Review and maintain pumps and equipment
- Maintain filters clean
- Purchase Energy Star equipment

KITCHEN

Refrigerator

- Maintain the back of the refrigerator clean and well ventilated
- Defrost the freezer before there is a 3mm thick ice layer
- Inspect the rubber seal on the refrigerator
- Do not place hot items in the refrigerator or freezer
- The refrigerator should be at 5° and the freezer at -18°C
- Try not to open the door too often and close it quickly

Cooking
• Use microwave when possible
• Avoid opening the oven when it is on and insure that it is well closed
• Use the pressure pot when possible
• Use residual heat to finish cooking. Shut off the stove and oven 5 minutes before finished time
• Cover pots and pans while cooking to take advantage of the heat
• Use convection ovens

Washing
• Rinse with cold water
• Use the dishwasher
• Use the dishwasher only when it is completely full and load according the the manufacturer
• Use economy and short programmes when possible
• Choose an energy star rated washer

Hot water
• Turn off hot water systems when the centre is closed
• The temperature should be set no higher than 40° C
• Use gas to heat the water when possible

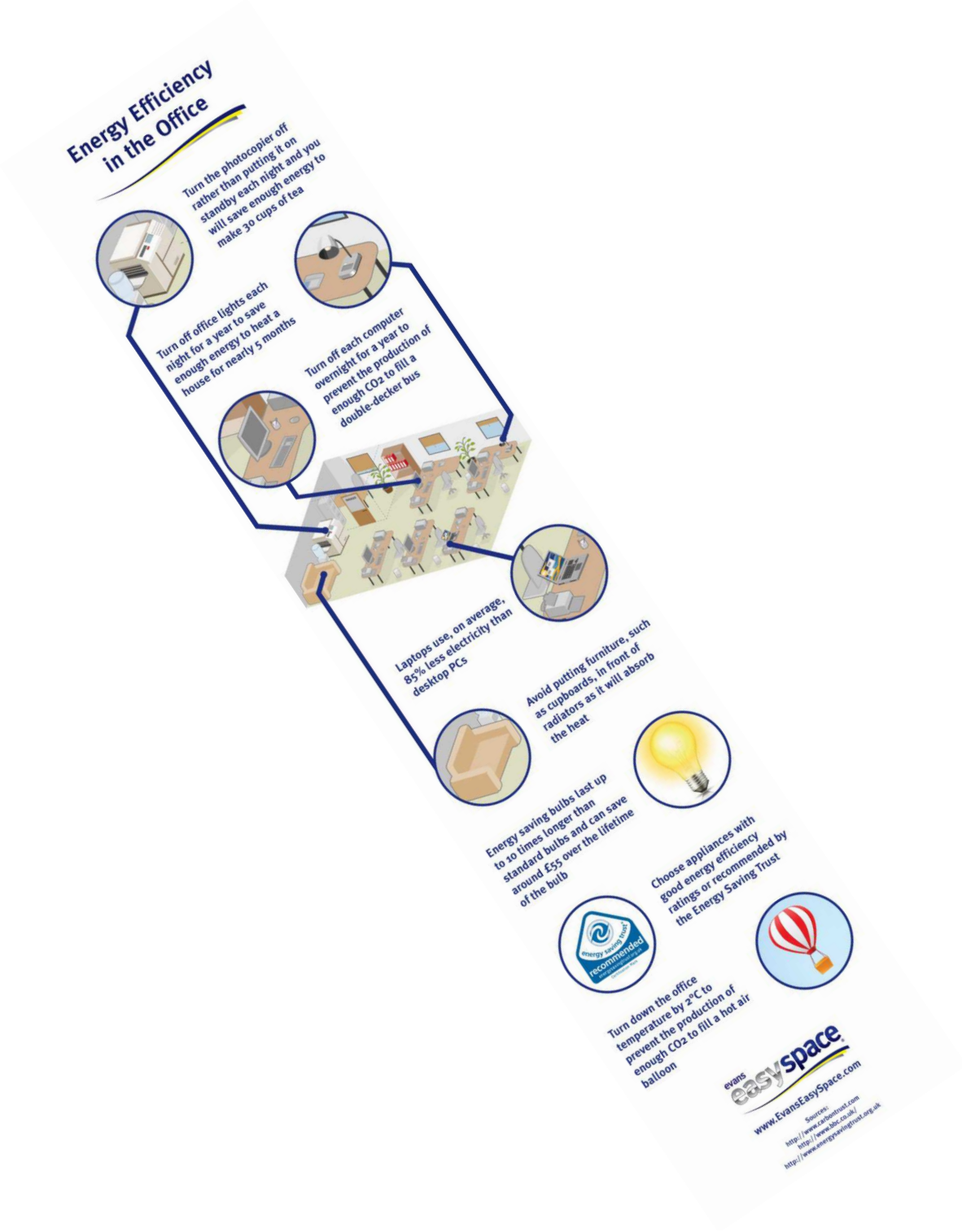
POOLS

• Reduce your heater or heat pump thermostat settings by 8-10° on days the pool is not being used.
• According to the American Red Cross, the most healthful swimming temperature is 25.5° C. Reducing your heater or heat pump thermostat to

maintain a 25.5° or lower temperature will also help conserve energy

- Reduce pump speed to reduce energy use. A slower pump reduces power consumption
- For good water maintenance, circulate water through a filter only once per day. Additional cycles tend to waste energy
- Run your pool's filtration system during off-peak hours when electricity demand is lower.
- Keep intake grates clear of debris. Clogged drains require the pump to work harder
- To obtain maximum filtration and energy efficiency, clean your filter regularly
- New variable drive pool pumps slash utility costs
- Raising the water temperature just 1° can costs an additional 10 - 30%
- Use LED or solar powered lighting

Sample office poster


Energy Efficiency in the Office
Turn the photocopier off rather than putting it on standby each night and you will save enough energy to make 30 cups of tea
Turn off office lights each night for a year to save enough energy to heat a house for nearly 5 months
Turn off each computer overnight for a year to prevent the production of enough CO2 to fill a double-decker bus
Laptops use, on average, 85% less electricity than desktop PCs
Avoid putting furniture, such as cupboards, in front of radiators as it will absorb the heat
Energy saving bulbs last up to 10 times longer than standard bulbs and can save around £55 over the lifetime of the bulb
Choose appliances with good energy efficiency ratings or recommended by the Energy Saving Trust
Turn down the office temperature by 2°C to prevent the production of enough CO2 to fill a hot air balloon
evans easyspace
www.EvansEasySpace.com

MYTHS FOR ENERGY SAVINGS

✘ Switching lights on and off uses more energy than leaving them on

FALSE: The energy used to switch a light on and off is less than that of leaving it on, so switching lights off when you leave the room saves energy, whatever type of bulb you have and for however long you are away.

✘ Leaving the heating on overnight uses less energy than re-heating a cold building

FALSE: A boiler that spends an hour heating up a room in the morning is working no harder than a boiler that spends 14 hours switched on overnight. The only difference is that one is switched on for an hour and the other for 14!

✘ Repeatedly turning computers and lights on and off reduces their lifespan, and wastes energy required to produce new ones

FALSE: Leaving computers on when not in use actually reduces their lifespan, because moving parts wear out faster. Lights are designed to be switched on and off many times a day without affecting their lifespan.

✘ Computer monitors use less energy when the screen saver is on

FALSE: LCD screens use exactly the same amount of energy, whatever color they are displaying, so the screensaver uses just as much energy as when you are working. It is recommended that if you are leaving your desk for a meeting is to switch off your computer screen.

✘ Leaving a ceiling fan on will help cool the room.

FALSE: Fans cool people, not rooms. So if a ceiling fan runs in an empty room, no one will feel its benefits. A fan works by circulating the air in the space; when the breeze moves across the skin, we feel cooler even though the temperature in the room is still the same. So when you leave the room, save energy by turning off the ceiling fan.

Attic fans are a different story. They can draw cooler air into the home and blow the hot air out that's trapped in the attic, increase energy efficiency. However, attic fans are only effective if the air outside is cooler than the air inside — usually during the early morning and evening hours.

✘ Turning the thermostat up or down will cool or heat the space quicker.

FALSE: Furnaces and air conditioners will acclimate a space at the same rate no matter how high you have set the temperature. It is best to set your thermostat at the desired temperature from the beginning avoiding losing energy in modifying the temperature in the end.

✘ Leaving a computer on is more energy-efficient than turning it on and off.

FALSE: It was always thought that turning your computer off and on would create additional wear on the device. This advice is yesterday´s news. Computers nowadays are tougher and switching them off when not in use is now the preferred practice.

ANNEX 11: EPLACE CASE STUDIES: Best Practices and Behaviors: Ireland, Spain and Bulgaria

IRELAND CASE STUDY:
TALLAGHT LIBRARY
SOUTH DUBLIN COUNTY CIVIC OFFICES
DUBLIN 24

Best practice or behaviour:	The energy audit carried out as part of the EPLACE Project identified preliminary opportunities for energy saving. The installation of the WeSave monitoring equipment will assist in further identifying energy saving opportunities through improved user behaviour. Best practice in staff energy management and awareness will be incorporated into training provided to the building manager and staff as part of the EPLACE project.
SITE INFORMATION:	
General information	Finglas Leisure Centre comprises a 25m swimming pool, a fully equipped gymnasium, a large aerobics studio, a Steam room and Sauna, a large changing village and 6 outdoor floodlit pitches. The leisure centre is open to the public seven days a week for a total of c 100 hours per week.
Building characteristics	The leisure centre was built in xxx. The building is a two storey lightweight steel framed structure with metal decking roof and side walls, with a total floor area of 2880 m2. The building was designed with energy efficiency in mind and includes high levels of insulation (with an average u-value of 0.46), heat recovery ventilation and a combined heat and power plant. In addition to standard glazing, daylighting has been maximised by the addition of roof lights in the pool hall, gym, reception and changing village. These roof lights

	provide a good glare-free source of natural lighting.
Building consumption	Swimming pool buildings are highly serviced building with potentially high energy consumption due to constant thermal and electrical loads throughout the year. There are significant energy demands for pool heating and heating and ventilation of the air space above the pool to maintain comfort and prevent condensation. Heating is provided by the CHP plant and condensing boilers. There are large electrical demands on the site for circulation pumps and fans with miscellaneous lighting and other loads. The WeSave monitoring equipment will identify electricity loads. The electricity use in 2012 was 380 MWh, costing €64,000 and the fuel use was 2,300 MWh costing €60,000. This equates to 148 kWhe/m^2/yr and 914 kWth/m^2/yr. These data are somewhat misleading as the CHP uses gas to generate electricity and data on the CHP operation is required to fully establish the electrical and thermal demands. This data will be measured by the WeSave.
Behaviours and practices prior to project:	It is suspected that there is scope to improve staff practices and control which will be determined and confirmed by the WeSave.
Behaviours that will be changed:	From the energy audit it is anticipated that the WeSave will identify significant energy saving opportunities through improved behaviour. Initiatives could include optimising the lighting control and switching off equipment when not in use or out of hours. From the electricity usage data we expect that the WeSave will identify a large amount of hours use that can be targeted through improved behaviour. This may, for example, include switching off lights, optimising time settings for plant, turning down fans out of hours and measuring and monitoring EnPIs through WeSave.
Energy and Environmental Performance	Baseline data on energy and environmental performance will be established after the installation of the WeSave.

Lessons learned	From the energy audits and the WeSave information there have been a number of lessons learned so far. 1. The work day in the library starts at 8.30 am but the spike in energy used commences long before this. One of the reasons may be the cleaners activating all lighting sensors when entering the building. 2. The base load at weekends is higher than the weekdays this is also unusual. 3. The environment in the library is poorly designed with very high temperatures in the summer time and very low temperatures in the winter. This leads to the need for additional heating and cooling that draw allot of energy. 4. Some lighting areas are not needed and may be switch off. All the sensors for lighting are on the one circuit so if the lux reading is low in one area it trips the lights for the entire library whether other areas have sufficient light or not. 5. Large banks of computers are being left fully on all day in classrooms when there is no class. The workers only have limited control over light, heat and cooling so behavioral campaigns will need to be tailored to this.
Suggestions for success	We had designed a ready to go behavioral campaign and have already implemented some of the actions, but having talked to the staff on the ground it became apparent they have very limited control over the operation of the building. It was therefore decided to alter the behavioral campaign to be more informative and concentrated on their comfort levels and how this can be affected. We will also introduce them to WeSave and how to 'read' the data so they can continue to monitor the energy after the life of the project. Information days will take place in the next few months that will educate the staff as to why and how we need to save energy.
Contact information:	Declan McCormac CODEMA Temple Bar Dublin 2 +353 1 7079818 dec.mccormac@codema.ie

IRELAND CASE STUDY:
TALLAGHT LIBRARY
SOUTH DUBLIN COUNTY CIVIC OFFICES
DUBLIN 24

Best practice or behaviour	The energy audit carried out as part of the EPLACE Project identified preliminary opportunities for energy saving. The installation of the WeSave monitoring equipment will assist in further identifying energy saving opportunities through improved user behaviour. Best practice in staff energy management and awareness will be incorporated into training provided to the building manager and staff as part of the EPLACE project.
SITE INFORMATION	
General information	The County Library, Tallaght, which reopened in April 2008 following a major refurbishment program, is in the heart of the cultural quarter of the Tallaght Town Centre, which includes the Civic Theatre, the Big Picture and Rua Red Art Centre. The County Library is a light filled, spacious and customer-orientated building which provides a large and up-to-date book stock, free state of the art computer faculties, self-service terminals, printing and photocopying systems, a digital training and a conference suite, a teen zone, a children's library and a local studies area, a download zone where customers can download audio books directly to their mp3 player or iPod from the on-line service and assistive technologies for people who have visual or reading difficulties. The County Library delivers open and welcoming access to leisure, information and educational opportunities.

Building characteristics	The library was refurbished in 2008. It extends to 2,550 m^2 over three floors. The levels of insulation in the building fabric are quite good with a weighted average u-value of 0.59 $W/m^2.K$. The lighting in the building is a combination of fluorescent T8 fittings, LED downlights, halogen lamps and metal halide spotlights.
Building consumption	The heating in this building is supplied by gas boilers situated in the main SDCC building which supply the heating demand to the whole campus. Electricity is used for lighting, public access PCs, the air handling unit for the library and general office equipment. The energy supply to the building is from the entire South Dublin Co. Co campus and is not separately metered. There is, therefore, no historic energy use data. The WeSave will provide baseline data when installed. From temporary measurement it is estimated that there is an annual electricity use of over 200 MWh and a nigh time baseload of 10 kW.
Behaviours and practices prior to project:	Lighting within the building is a significant energy user and is controlled by PIR occupancy sensors throughout. It is suspected that there is scope to improve staff practices which will be determined and confirmed by the WeSave.
Behaviours that will be changed:	From the energy audit it is anticipated that the WeSave will identify significant energy saving opportunities through improved behaviour. Initiatives could include optimising the lighting control and switching off equipment when not in use or out of hours. From the temporary measurement we expect that the WeSave will identify a large out of hours use that can be targeted through improved behaviour. This may, for example, include: powering down public access PCs at closing time, switching off staff PCs, switching off office equipment and restricting the use of electric heaters.
Energy and	Baseline data on energy and environmental performance will

Environmental Performance	be established after the installation of the WeSave.
Lessons learned	From the energy audits and the WeSave information there have been a number of lessons learned so far. The ancillary lighting in areas such as hallways, stairwells and common areas is not always needed, management have started to instruct staff to switch these areas off when not needed. The BMS system has become out of synch with the buildings systems and will be modified to operate automated systems more efficiently. There are cycles of the CHP system when it exports heat and electricity, this will be examined. Computers and office equipment are being left on after hours, the behavioral campaign will address this. Overall pool, shower and air temperatures will be examined to see if they can be reduced
Suggestions for success	We had designed a ready to go behavioral campaign and have already implemented some of the actions, this will consist of published material, workshops, energy days and the use of staff as energy ambassadors to help deliver actions. These ambassadors will also be trained on the WeSave system.
Contact information:	Declan McCormac CODEMA Temple Bar Dublin 2 +353 1 7079818 dec.mccormac@codema.ie

SPAIN CASE STUDY:

CULTURAL CENTRE OF THE TOWN
CARTAYA, HUELVA

Best practice or behaviour:	There are currently no defined guidelines of good practices, but there are some that have been implemented ✓ Turning off lights in unused areas. ✓ Reduce the conditioned air consume.

SITE INFORMATION	
General information	The Cultural Centre of Cartaya is located in the Calle Nueva 16, CP 21450 in Cartaya, Huelva. Is a Facility Building for the citizens, where they have access to: 1. Library. 2. Archive. 3. Theatre 4. Exhibition and conference room. 5. Municipal Academy. 6. Classroom Testing. 7. Cultural Workshops. 8. Information Offices, registration, management and administrative claim. 9. Offices and rooms for staff providing services 10. Hall and Conferences room. 11. Workshops, meeting room. 12. Multipurpose rooms and common. The Staff is about 14 persons, and estimated building users is at around 6,000 people/year.
Building characteristics	The building was completed in 2004, is a typical polyvalent centre with a great Hall, and several rooms including a Theatre. It extends to 3.392,75m^2 over 5 floors. There are some great areas, with a special difficulty for the climate, such as Hall, library and theatre. And of course, due to its special characteristics, with high energy consumption.
Building consumption	As said before, a building like this has several kind of rooms, a great Hall, library and classrooms with a great light and climatization consumption. The most part of energy consumed is electrical. The summer season in this region is quite warm (25º-40º) and need a great amount of energy to be climatize. The actual consumption is about 166.518Kw
Behaviours and practices prior to project:	The particular nature of the building makes it difficult to provide solutions to modify the user's behaviours. However, all the efforts will be focused to define a better policy strategy for this building. Special events like theatre, carnivals and cultural activities, have high demands on energy consumption. They are designed for volumes of people and must use all lights and heating or cooling systems. During these punctual events a lot of

	energy could be save, but this is an ambitious project and the total implication of the Council is needed to change behaviours and several energy vampires (some machines, bulbs, boilers, etc.)

Behaviours that will/have been be changed	Definitely general actions in this building will be more effective than concrete actions. The "Standby" campaign had no a great effect in the total building energy consumption, does represent some benefit in energy savings. This is because of the large dimensions of the building. The largest energy consumers are: lighting and air conditioning. One of the air conditioning units is broken, so the building now is "by default" saving money. The users have changed some behaviours in this way, and will be recommend not to use personal cooling systems and instead use fans. Some other behaviours to change will be related with the outdoor light use as well as the use of curtains, awnings and blinds to reduce external heat from affecting the internal temperatures. During the mild winters of Cartaya natural light is recommended to light the building. This will increase energy savings and decrease energy consumption by taking advantage of the sun´s heat. Other behaviours related with healthy recommendations, include the minimization of using the lift and promote using the stairs. It is also recommended no to use hot water over 40 degrees, not to drink cold water, use paper towels instead of air machines, etc.
Energy and Environmental Performance	**Baseline data on energy and environmental performance will be established after the installation of the WeSave.**
Contact information:	**Gerardo Romero León** **AV. Del Conocimiento s/n 18016** **Granada – Spain** **+34671569627** **www.consorciofernandodelosrios.es**

SPAIN CASE STUDY:

CITY TOWNHALL
CARTAYA, HUELVA

Best practice or behaviour:	There are currently no defined guidelines of good practices, but there are some that have been implemented ✓ Turning off lights in unused areas. ✓ Reduce the conditioned air consume.

SITE INFORMATION	
General information	The building is a four-storey building: basement, two floors and an attic - The ground floor houses are the Department of Citizen Services and Economic Department. The Municipal Police is situated inside with independent access from the street -The second floor houses are located the political bodies: Hall, Secretariat, Council Chamber, Committee on

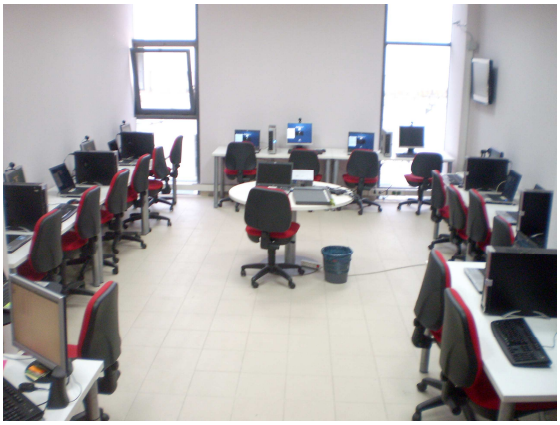
	Government, Legal Services and Public Relations room. -In the basement is located the area of Planning, Construction and Services - And in the Attic the IT Department The Staff is about 14 persons, and the number of users is about 6.000 people/year.
Building characteristics	Number of buildings [number]: 1 Completed: 2006 Total Floor area [m^2]: 1666,50 m2 Total number of users [number]: Capacity 45 workers and 5.000 users/ year Electricity demand [kWh/m^2/y]: There are 3 counters: Power 1: 9.13 Kw Power 2: 5.5 Kw Power3: 195 Kw
Building consumption	A building like this has several kind of rooms, offices, assembly Hall, etc. with a great light and climatization consumption. The most part of energy consumed is electrical. The summer season in this region is quite warm (25º-40º) and need a great amount of energy to be climatize.
Behaviours and practices prior to project:	This building includes several departments that are located in different parts of the building. Some of them are accessible to the public and others are used for internal services. There are different needs for each kind of users, but there are only some practices implanted in the building: • Switch off computers and machines not in use. • Switch off lights in vacated areas.

Behaviours that will/have been be changed	The "Standby" campaign had no a great effect in the total building energy consumption, but is a plus to save energy. The main technician responsible explains that people in the Town Hall usually switch off the computers at the end of the day. Some recommended actions have been made as not to use personal cooling systems (ventilators) or personal heaters in

	winter. Some other behaviours to change are related to the outdoor light use and the use of curtains, awnings and blinds to avoid the affects of the excessive of the region. On the contrary, during mild winters in Cartaya, it is recommended that natural light be used in the building. This will increase savings and lower energy consumption. The use of natural light can also help to increase the inside temperature of the building. Other behaviours related with healthy recommendations include not using the lift and use the stairs instead. It is also recommended to not use hot water over 40 degrees, don't drink cold water, use paper towels instead of air machines, etc.
Contact information:	**Gerardo Romero León** **AV. Del Conocimiento s/n 18016** **Granada – Spain** **+34671569627** **www.consorciofernandodelosrios.es**

SPAIN CASE STUDY:

GUADALINFO TELE
CENTRECARTAYA, HUELVA



Best practice or behaviour	There are currently no defined guidelines of good practices, but there are some that have been implemented ✓ Turning off lights after the work. ✓ Reduce the conditioned air consume. ✓ Switch off computers and monitors every day.
SITE INFORMATION	
General information	The Guadalinfo Telecentre is located on 2, C/Hospital Street, Cartaya – Huelva. This is a public centre created to reduce the digital gap in the rural environment. Social Innovation, computer courses and everything related to new technologies, focused to improve the social progress in the villages. Also have a few hours of free access to online consultations, implementation of academic papers, etc.
Building characteristics	Is a 150m^2 room, diaphanous inside the Local Market Building. Electronic Equipment: 26 Computers (10-15

	Portable Desktop), projector, TV, 2 switches 1 router, 2 printers (laser and Multifunction).
Building consumption	Is a medium room that needs to be acclimatize, and the electric consumption for the amount of PC's described before. The actual lighting consumption is about 5Kwh/m2/y
Behaviours and practices prior to project:	The Guadalinfo telecentre had no prior behaviour policy, so there is a great improvement opportunity. The centre is coordinated by a manager, who can directly be in charge of users' behaviours.
Behaviours that will/have be changed:	This Telecentre is optimal to introduce changes in users' behaviour. One of the most important changes is switching off computers that are not being used. Computers are the most important energy consumers in the centre. The manager will control the use of lights, opened windows as well as the main door, to avoid heat or cooling losses.
Energy and Environmental Performance	Baseline data on energy and environmental performance will be established after the installation of the WeSave.
Contact information	Gerardo Romero León AV. Del Conocimiento s/n 18016 Granada – Spain +34671569627 www.consorciofernandodelosrios.es

BULGARIA CASE STUDY:

MEDICAL CENTER OF SEPTEMVRI CITY
MASSIVE BUILDING
SEPTEMVRI CITY, PAZARDZHIK DISTRICT

Best practice or behaviour:

Replacing existing windows with new, energy efficient.

SITE INFORMATION:

Location of the building

Type of building	Activities practiced	Number of staff	Number of building users / year
Massive building	Medical activities	114	60 000

Building characteristics:

Type of building	Activities practiced	Number of staff	Number of building users / year

Massive building	Medical activities	114	60 000
Year built	Climate zone		
1958, Overhaul in 1992 year	Climate zone 6, Bulgaria. Minimum temperature: –16 oC Maximum temperature: +34 oC		

Building size			
Gross floor area	Heated area	Heated volume	Floors
m2	m2	m3	number
1 736	1 736	5 017	2

Building consumption:

Fuel types used	Annual consumption		Estimated CO_2 production, ton (prior to project start)*
	Cost, €	kWh/ 2/year	
Electricity	5 759.85	34.93	41.41
LPG	1 012.31	7.90	3.73
Total:	6 772.16	42.83	45.14

*When produce 1 kWh of electricity are generated 683 g CO_2/kWh, LPG – 272 g CO_2/kWh. Total annual consumption of the building is 74 340 kWh.

Behaviours and practices prior to project.	Exterior windows have a high heat transfer coefficient U (W/m2.K). This is the reason for the heat loss. In relation to staff behaviour – no training activities or behavioural change campaigns have been performed previously; for this reason, it is expected that such actions can lead to significant results in building's energy performance.
Behaviours that will be changed:	From the energy audit it is anticipated that the WeSave will identify significant energy saving opportunities through improved behaviour. Initiatives could include activities like: switching off all office equipment not in use by establishing the "Stand By" mode; try to avoid air-conditioning and use fans instead; building manager checks after work to ensure electric devices are switched off; usage of shutters and awnings during

	hot summer days; reduce the use of hot water as much as possible; try to avoid the use of individual electric heaters during cold winter months as much as possible; open windows during winter mornings for 5 minutes in order to aerate interior air.
Energy saving measures:	Installation of new, energy efficient exterior windows (408 m2). This will up led to a reduction U-value from 3.25 to 1.80 W/m2.K. Energy consumption for heating will be reduced by 17 842 kWh (24%).
Energy and Environmental Performance.	Energy savings – 17 842 kWh/y CO_2 savings – 34.3 ton/y Energy Cost savings – € 1 625.32 y Success will be monitored by measuring the monthly energy consumption after implementation of measures and comparisons with the consumption before. Benchmarks were established and changes will be monitored: through constant monitoring of energy consumption.
Contact information:	Address: 80 "Bulgaria" boul., Septemvri City 4490, Bulgaria Person of contact: Galina Dishkova Email: g.dishkova@septemvri.org Website: www.septemvri.org

BULGARIA CASE STUDY:

ADMINISTRATIVE BUILDING OF THE MUNICIPALITY OF SEPTEMVRI
MASSIVE BUILDING
SEPTEMVRI CITY, PAZARDZHIK DISTRICT

Best practice or behaviour:	**Thermal insulation of the building envelope, includes:** ✓ thermal insulation of external walls ✓ thermal insulation of the roof

SITE INFORMATION

Location of the building

Type of building	Activities practiced	Number of staff	Number of building users / year
Massive building	Administrative activities	105	38 000

Building characteristics:

Year built	Climate zone
1978	Climate zone 6, Bulgaria. Minimum temperature: –16 oC Maximum temperature: +34 oC

Building size			
Gross floor area	Heated area	Heated volume	Floors
m2	m2	m3	number
3 687	3 687	12 905	4

Building consumption:

Fuel type used	Annual consumption		Estimated CO_2 production, ton (prior to project start)*
Electricity	Cost, €	kWh/m2/year	173
	27 10.67	68.7	

*When produce 1 kWh of electricity are generated 683 g CO_2/kWh. Total annual consumption of the building is 253 296 kWh.

Behaviours and practices prior to project.	✓ External walls and the roof have a high heat transfer coefficient U (W/m2.K). This is the reason for the heat loss. ✓ In relation to staff behaviour – no training activities or behavioural change campaigns have been performed previously; for this reason, it is expected that such actions can lead to significant results in building's energy

	performance.
Behaviours that will be changed:	From the energy audit it is anticipated that the WeSave will identify significant energy saving opportunities through improved behaviour. Initiatives could include activities like: switching off all office equipment not use by establishing the "Stand By" mode; try to avoid air-conditioning and use fans instead; building manager checks after work to ensure electric devices are switched off; usage of shutters and awnings during hot summer days; reduce the use of hot water as much as possible; try to avoid the use of individual electric heaters during cold winter months as much as possible; open windows during winter mornings for 5 minutes in order to aerate interior air.
Energy saving measures:	✓ Installation of insulation of 1 741 m2 exterior walls that will reduce the U-value from 1.05 to 0.35 W/m2.K. Electricity consumption for heating will be reduced by 45 593 kWh (18%). ✓ Installation of insulation on the roof (922 m2). U-value will decrease from 0.6 to 0.3 W/m2.K. Electricity consumption for heating will be reduced by 32 928 kWh (13%).
Energy and Environmental Performance.	Energy savings – 78 521 kWh/y CO2 savings – 53.6 ton/y Energy Cost savings – € 8 401.83 y How will the success of this change be measured? By measuring the monthly consumption of electricity after implementation of measures and comparisons with consumption before. Please explain how benchmarks were established and how changes will be monitored: Through constant monitoring of energy consumption.
Contact information:	Address: 37A "Aleksandar Stamboliyski" boul., Septemvri City 4490, Bulgaria Person of contact: Stefka Popova, Deputy Mayor

	Email: s.popova@septemvri.org Website: www.septemvri.org

7. BIBLIOGRAPHY:

1. Alexandra Langenheld, et. al. Energy Efficiency in Public Procurement – Member States' experience, barriers/ drivers and recommendations. Joint Research Centre of the European Commission. May 2010
2. Baltic Climate. Tool Kit. http://toolkit.balticclimate.org. September 2013
3. Energy Star. ENERGY STAR Building Upgrade Manual. 2008 Edition
4. Energy Star. ENERGY STAR. Qualified Products. www.energystar.gov. September 2013.
5. Environmental Protection Agency (US). Green House Gas Equivalencies Calculator. www.epa.gov/cleanenergy/energy-resources/calculator.html. September 2013,
6. EPEC. European PPP Expertise Centre. Guidance on Energy Efficiency in Public Buildings. 2013.
7. Evans Easy Space. Poster: Energy Efficiency in the Office. http://cleantechnica.com/2012/12/23/energy-efficiency-in-the-office/evans-energy-saving-tips/. September 2013.
8. Government office of the South West (UK). Corporate Responsibility. Managing Change. How to manage change in an organization. January 2007 edition
9. ICLEI for the European Commission. European Commission Green Public Procurement (GPP) Training Toolkit - Local Governments for Sustainability, 2008.
10. ISO 50001:2011 and ISO 14001:2004– Energy Management System
11. National Maritime Museum. Royal Observatory. Energy Management Policy. June 2010
12. National Renewable Energy Laboratory (NREL) U.S. Department of Energy. Energy Efficient and Renewable Energy checklist. August 2013
13. Paul Scheckel. The Homeowner´s Energy Handbook. Storey Publishing. 2013
14. Public Sector ICT Special Working Group. 2013
15. Save on Energy, Ontario. OPA Energy Management Plan Template. December 4, 2012
16. Simon Clement, et al. Driving energy efficient innovation through procurement: A practical guide for public authorities. The SMART SPP consortium. 2009.
17. Sustainable Energy Authority of Ireland. Energy Map. www.seai.ie/energymap. September 2013.
18. Sustainable Energy Authority of Ireland. Guide to ICT –Desktop Energy Management
19. Sustainable Energy Authority of Ireland. Media report: SEI Report Shows Average Irish Household Emitting 8.1 Tonnes of CO_2. 17 June2008